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Pioneer's 'Simple Solution' surround sound set

NDD

JULY 1999

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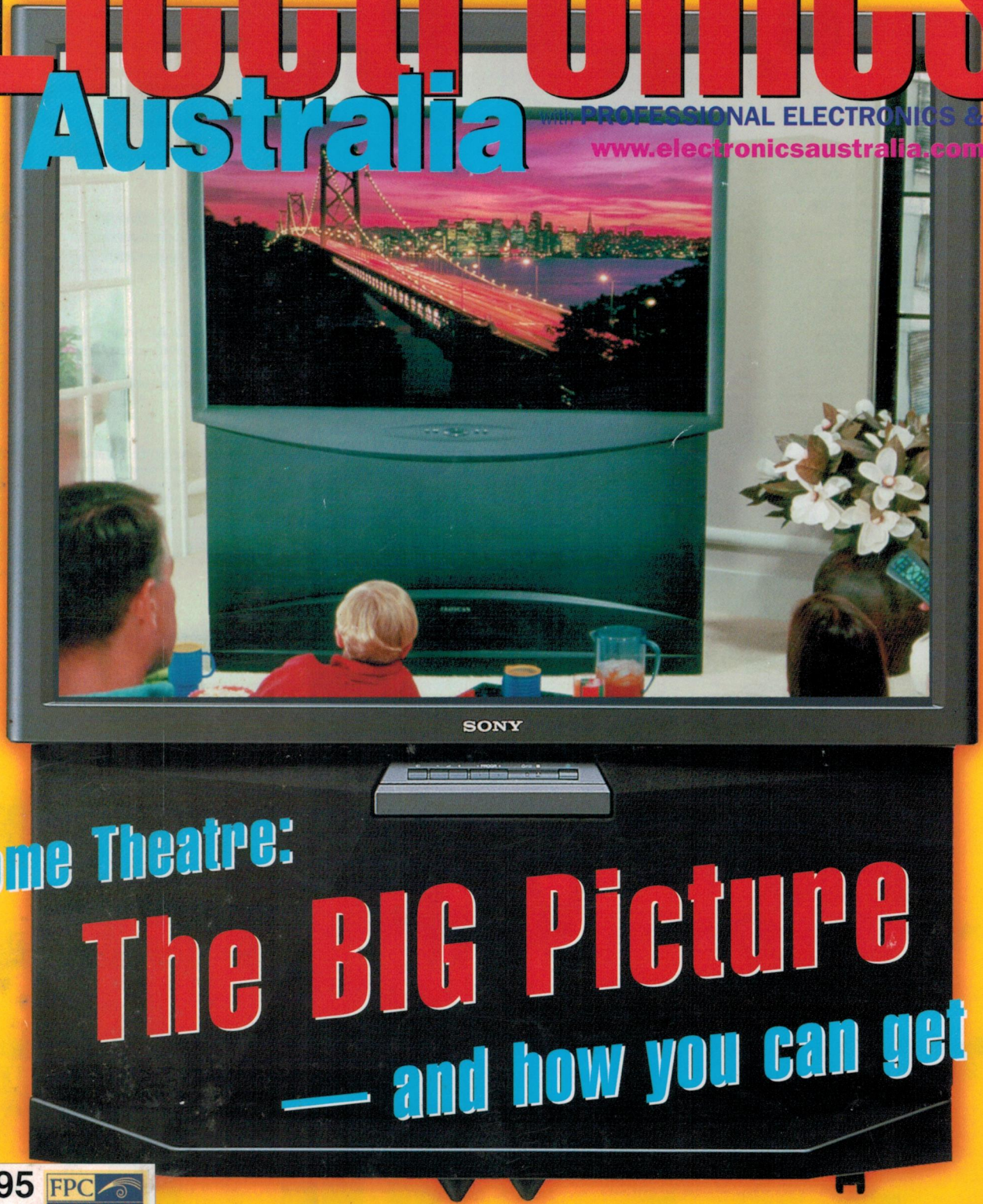

Home Theatre:

The BIG Picture

— and how you can get it!

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How to build a low cost PC-driven X-Y Plotter...

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"Simply...the best performance and value for money available!"

Signature
SURROUND PACKAGE

"One could be forgiven for thinking that these speakers were 10 times the price...The stereo imaging was truly outstanding...The VAF Signature I-51 system has one of the finest high frequency responses of any
Electronics Australia

"Are these the best kit speakers in the world?...On the evidence, we'd have to say that VAF's I-66 design would be odds on favourite to take out the award."
Best Buys Speakers, Amplifiers, Receivers

"... don't think there's any other way you could obtain this high level of sound quality at such a low price..."
Australian Hi-Fi

"The VAF DC-Series home theatre system exhibits a new benchmark of excellence in every criteria: construction, design finish , innovation...it seems almost churlish to mention the astounding value that each of these components represents."
Best Buys Home Theatre

"A new benchmark in excellence in every criteria: construction, design, finish, innovation."
Best Buys Home Theatre 97' 98'

"Highly and unreservedly recommended."
Best Buys Home Theatre

"... In value for money stakes or even sound for dollar stakes for that matter, they're nigh on impossible to beat."
Australian Hi-Fi

"We love the DC-Xs. These are true high fidelity speakers, and deserve a pedigree second to none. we are confident that that will be the case in time. Their performance is a revelation. The combination of the DC-Xs, the DC-6 and DC-2s is a happy, fully compatible, articulate and balanced system that beats anything we can think of in its price range. Actually,probably close to twice its price range."
Best Buys Home Theatre 98' 99'

"All areas of the DC-X's performance could easily be attributed to models costing a great deal more...The very design of the DC-x sets a few new standards in speaker engineering, some of which help it achieve incredible levels of versatility across amplifiers and source products and Home Theatre applications...Amazing value!"
Audio Video Lifestyle Magazine

"Unmatched performance at the price.The new DC-2 significantly raises the standard by which speakers at its price will be measured. This speaker is destined to become a classic."

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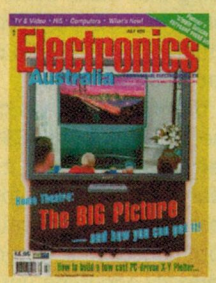
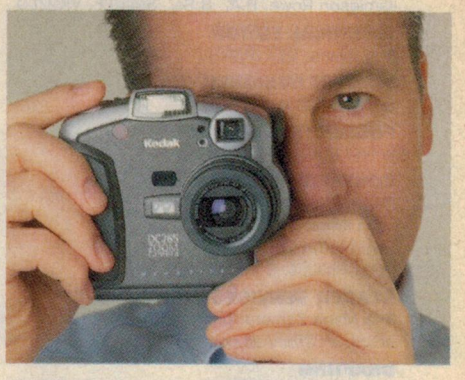


For most people, the trickiest part of setting up a home theatre is picking the most appropriate 'big picture' display. There are so many choices — all quite pricey, too. Our feature starting on page 16 is aimed at giving you enough knowledge to make the right choice. (Composite photo courtesy Sony, BusinessWire)

More Kodak megapixels



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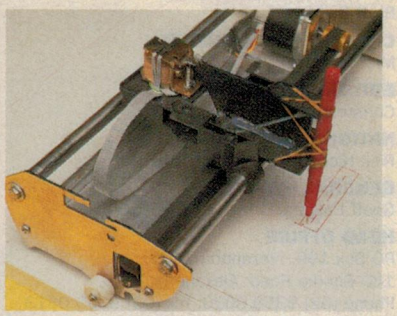
No doubt about it: Kodak can deliver excellent value for money. Take its new megapixel digital cameras...

Plotter from printer bits...



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To be honest, we didn't expect it would be as easy as this — but Oatley's team found a way!

Big and *really* bright

22

Need a big hi-res (XGA) display that's really bright? Fujitsu's new LPF-5200 delivers an impressive 1000 lumens...

Professional Electronics

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Letters to the Editor

Electronics clubs

I read with interest the recent letter bemoaning the lack of 'Electronics Clubs' which kids can join.

I well remember as a child in the early 1950's in the UK, a local guy ran a radio club in a musty room over a shop and we all paid sixpence a week towards the rent. I learned much about radio and, more importantly, had the pleasure of mixing with like minds. This all started me on a career which I love.

How things have changed. A few years ago I was visiting a local Community Youth Support Scheme to deliver some equipment. There were about four professional social workers tending the small flock of out-of-work kids and running courses on how to cook nutritious meals on the dole and how to play the guitar (to pass the time I guess).

I suggested that, as a computer engineer with experience in training, I could donate a couple of old computers and some back copies of *EA*, then run informal evening classes in word processing, programming etc. This would give the kids some skills and increase their chances of getting a job.

Boy! Did I say the wrong thing. The social worker was horrified. We can't let volunteers loose on the kids, she replied. So I suggested that I just leave the magazines? No, that would not fit in with the structure of what they were doing. That was the end of the conversation.

I do a lot of volunteer work in museums etc., but I'm afraid that volunteering to work with kids may not be politically correct any more.

John Rich, Petersham NSW.

Y2K card review: 1

March 1999's Electronics Australia reviewed a Y2K card. The reviewer is right that there are three rules that determine whether a year is a leap year. The first says that if it is evenly divisable by four, it is. The second says that if it divisible by 100 it isn't, no matter what the first rule says. The third says that if it is evenly divisable by 400 it is, after all.

The reviewer is also right that that very few BIOSs implement the third rule, but only because they don't implement the second rule either. BIOS writers aren't as stupid as he makes them out to be. The only year between 1901 and 2099 when rule two applies it is cancelled by rule three, so virtually all BIOSs simply check to see if the year is evenly divisible by four.

Actually the easiest way to make a PC's hardware effectively Y2K compliant is to install Windows 98 or Windows NT 4 on it. Most people don't know that. They also don't know which PCs are or are aren't likely to have Y2K problems. I'm yet to see an IBM that's BIOS isn't OK. For most other brands if it has a Pentium 133 or slower, you should check it.

Of course the computer industry can be remarkably stupid. Like Microsoft shipping Service Pack 4 for Windows NT 4, having you install that, then when you attempt to install the Option Pack that comes with it, you're told you shouldn't — because Microsoft hasn't checked to see whether it is compatible with SP4.

Gordon Drennan, Ultimo NSW.

Y2K card review: 2

You should really get the forensics in to check the *Electronics Australia* coffee!

First Peter Phillips' battery confusion and now Jean-Baptiste Cattley's nonsense in the above article. In Jean-Baptiste's case I am really surprised as he always seems to have such a good grip on things.

The whole paragraph headed 'Leap Year' is utterly confused. The comment that 'Very few systems take this last proviso into account', (the proviso being that years divisible by 400 are leap years) is perfectly true, however the conclusion 'and will refuse to acknowledge the existence of the 29th of February, 2000' is not true. The reason being that these same systems will not take the previous proviso into account either. (That is: Years divisible by 100 are not leap years).

The most common clock chips used, the Motorola MC146818 and the derivatives based on it, have a two-digit year and treat every fourth year as a leap year. With the application of a little commonsense in programming this is perfectly adequate until the year 2099.

I acknowledge that there can be a problem with some BIOS's. There are some pretty dumb BIOS's around, some will only allow the installation of very

restricted range of hard disks. Given the nature of most home usage, a much more serious problem.

Of the machines I have seen about 1 in 50 has had a faulty BIOS in respect of Y2K. It is relatively easy to check, and users should do their own checking. There is at least one free Y2K utility which is distributed on the Net and sometimes front cover CDs which is a sham. It identifies computers as being not Y2K compatible, and suggests that software is purchased to fix the problem, when there is in fact no problem.

Graham Shepherd (by e-mail)

Incomplete manuals

Hands up anybody who will buy a street map of Sydney, with no street names or house numbers for $19.00. No takers?

I have in effect bought just such a thing, on several occasions — namely service manuals, the schematic of which has no voltage callouts or scope patterns, rendering it practically useless. I am sure the manufacturers are aware of how difficult it is to carry out any sort of repair without this vital information; the only conclusion that I can come to is that this information is suppressed, for reasons known only to themselves...

On this occasion, it's an NEC CTV model FS6806S with twitching horizontal scan, eventually developing into loss of video, then vertical collapse. All very intermittent, so that resoldering of any joint on the motherboard cures the fault for a few seconds to a few hours. Heat and freezer have no effect. All power rails are locked in solid with no ripple of any consequence.

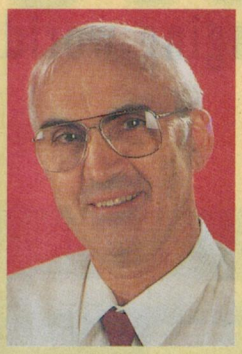
I have traced the fault into the surrounds of the jungle IC201 (M52778SP) but dare not go further without a panga and snake bite outfit.

I will be grateful for any help I can get on this fault, please email to **trevsam@bigpond.com.au**.

Trevor Salmon (by e-mail) ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

Editorial Viewpoint



Helping you find your way through the 'big picture' jungle...

UNTIL THIS YEAR, ONLY a relatively small number of well-heeled Australians seemed to find setting up our own 'home theatre' an attractive and feasible proposition. Probably that's been due to a number of factors, including the cost and complexity of the technology involved if you wanted to get a really satisfying presentation.

Happily that's now changing. Thanks to the availability of DVD players and the gradual release of movies on DVDs, there's now an affordable software medium capable of delivering really high quality video and audio — i.e., with the potential for satisfying 'big screen' viewing. Hardware manufacturers have also made big strides in lowering the cost and complexity of surround sound, making it not only more affordable, but much less of a hassle to set up as well. (An excellent example of this is Pioneer's innovative HTV-1 'Simple Solution' system, reviewed on page 14 of this issue.)

However one of the things I've become aware of lately, in looking at some of the developments in home theatre technology, is that for many people, the picture side is the 'hard part'. What *is* the best way to go, when it comes to achieving a 'big picture'?

Even for those of us with a reasonably technical background, there's quite a bewildering range of different technologies available: TV sets and video monitors based on large CRTs, rear-projection sets, video projectors based on CRT, LCD or DLP technology, plasma panels and so on. Inevitably each has its own strengths and tradeoffs. All of them are still fairly pricey, while the most expensive are virtually beyond the range of all except millionaires and corporations. So deciding which approach is 'right for you' is really quite important, despite the difficulties; making a mistake could be very expensive.

That's the reason for this month's cover story, then. What we've tried to do is boil down all of the technical information and marketing hype, and put this together with our own experience in reviewing and using the technology to provide you with an easy to understand guide to each of the types of big screen display currently available. What its strong points are, what the tradeoffs tend to be, and what you can expect to pay. Hopefully you'll find it not only interesting reading, but also helpful background information when you're trying to decide what to buy.

By the way there's also a review of Fujitsu's new LPF-5200 LCD video projector (page 22), which offers true XGA resolution and a very impressive 1000 ANSI lumens of output. It's an excellent example of that particular approach to big picture presentation, as it happens.

Of course another area of consumer electronics where the developments now seem to be coming ever more rapidly is digital cameras. Every other week one of the manufacturers seems to announce a new model or range offering much higher resolution and/or significantly lower price, plus perhaps more 'pro' features and easier transfer of images into the bargain.

It's not easy keeping up with these developments, but this month we're continuing to try. On page 10 you'll find an article on the latest models from Kodak, while there's a preview of a couple of new models from Olympus in the 'What's New' section starting overleaf. We hope to review the new Camedia C-2000 Zoom shortly, just as soon as we can get our hands on one...

Jim Rowe

WHAT'S new

in the ever-changing world of electronics

New Philips DVD has enhanced features

Philips says that premium quality home cinema is now available at an affordable price with its new DVD 725, offering advanced picture and sound features. The DVD 725 comes with advanced features such as a resume function, allowing playback to be stopped at any point in a movie and resumed at the same point, even days later. The player 'remembers' where playback has been interrupted in up to five discs.

With the DVD 725 you can also take advantage of various TV formats like widescreen 16x9, standard 4x3 and letterbox to ensure optimum viewing enjoyment.

Sound quality is claimed as outstanding, with studio-grade multichannel sound reproduction that fills the room with convincing, all-round sound and effects. One of the first DVDs to incorporate Digital Theatre Sound (DTS), it can even create a virtual 3D sound effect using just two speakers.

The DVD 725 is also claimed to be particularly easy to operate. All main functions are accessible from a stylish remote control with on-screen operating menus in a choice of nine languages.

Unlike many DVD players, the DVD 725 can also play audio CDs produced at home in CD-R (CD-Recordable) and CD-RW (CD-Re-Writable) formats. The dual laser optical pick-up unit ensures high precision readout of whichever type of disc is being played.

Quoted RRP for the new Philips DVD 725 is $1099. For more information call Philips Electronics on 1300 363 391 or at **www.philips.com.au**.

Dilbert now a TV star

Dilbert, the much loved cartoon character created by US cartoonist Scott Adams, has now moved beyond his globally syndicated three-panel cartoon strips, books and very popular website (**www.dilbert.com**) — into television. The Dilbert TV show has already made a very successful debut in the US, and is shortly to begin here in Australia on Channel Ten.

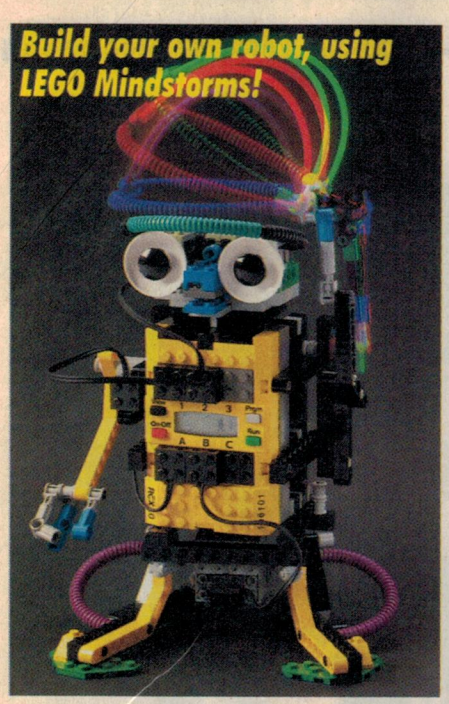
Already seen by more than 150 million readers each day around the world, in over 1900 newspapers and magazines, Dilbert satirises the illogical behaviour of bosses, the tyranny of co-workers and the tiny daily stupidities of office life. Dilbert himself is a lowly cubicle-dwelling engineer, whose boss is 'an egomaniacal twit'. To make matters worse, his pet and companion Dogbert has eclipsed him in the corporate world by launching his own management consulting business.

Bringing the two dimensional Dilbert team to life for the TV screen are Emmy award-winning producer Larry Charles (*Mad About You*, *Seinfeld*), with the unmistakable voices of Daniel Stern (*The Wonder Years*) as Dilbert; Chris Elliot (*There's Something About Mary*) and Cathy Griffin (*Suddenly Susan*) as Dilbert's caffeine-charged colleague Alice.

Smart fridge does the shopping

Want a fridge that does more than just keep things cold? In the USA, Frigidaire Home Products has demonstrated this concept online fridge at the 1999 Kitchen and Bath Industry Show.

With a PC and touch-screen flat panel monitor built into the door, the fridge provides everything needed to perform convenient at-home shopping via the internet. Frigidaire suggests it's a sign of the future... (Business Wire)



LEGO building blocks have long been part of Australian children's toy boxes, and the new LEGO Mindstorms use the traditional building block concept combined with a microcomputer. They were successfully launched in the UK and USA in 1998, after more than a decade of research and development between the LEGO Group and the Media Laboratory at the Massachusetts Institute of Technology (MIT).

The Mindstorms robot is built from LEGO bricks and the RCX (a LEGO microcomputer that can be programmed using a PC). A powerful but simple programming language is used to determine how the robot should behave. The program is downloaded to the robot via an infra-red transmitter, at which time it is set in motion to react to its environment using special bricks with light and touch sensors. Robot inventions can be programmed to move and perform an unlimited variety of actions.

Now LEGO Mindstorms are available in Australia, through Dick Smith Electronics stores.

"LEGO Mindstorms is an ideal product for Dick Smith Electronics because it combines our background as a leading electronics retailer and our desire to offer the latest and greatest technology", said DSE's Managing Director, Jeff Grover.

The LEGO Group has also established an Internet site, **www.legomindstorms.com** that allows people to create their own personal home page, upload programs, display their robotic inventions and communicate with other users.

LEGO Mindstorms is available from Dick Smith Electronics stores Australia wide and also DSE's Powerhouse stores at Penrith, Bankstown, Moore Park and Carnegie for an RRP of $428, or via mail order by calling DSE Direct Link on 1300 366 644.

New high-end digicam from Olympus

Not to be outdone in the image resolution and performance stakes, Olympus has just released a new high-end digital camera: the Camedia C-2000 Zoom. Features include a 2.1 million pixel (1600 x 1200) image sensor and a 3X optical zoom lens (f/2.0) described as 'super sharp'. The RRP is $2299.

Portable DVD player with LCD screen

Panasonic has now released its DVD-L10 portable DVD player in Australia, following considerable success in the US and Japanese markets. Designed for portable viewing of DVD titles, the DVD-L10 includes a built-in LCD screen, weighs only 910 grams and measures just 160 x 160 x 43mm.

The built-in 5.8" (145mm) screen has a 16x9 aspect ratio, which shows widescreen movie images at optimum resolution. To view standard images or letterbox formats recorded at 4x3 aspect ratio, the user can select Normal, Full or Zoom display modes. The 280,000-pixel screen provides crisp detail, and TFT active matrix LCD technology ensures a bright picture with a wide viewing angle and minimal reflection. The DVD-L10 claims more than 500 lines of horizontal resolution, and has a 10-bit video D/A converter, claimed virtually to eliminate video noise and maximise picture quality.

A pair of built-in speakers deliver high-quality stereo sound, while the nickel metal hydride battery offers around two hours of continuous playback.

The player is also a space-saving addition to home theatre solutions. S-Video and composite video outputs allow connection to a TV for home viewing, and a full wireless remote is included. The DVD-L10 supports PAL and NTSC playback on PAL TVs, and can also play standard audio CDs and Video CDs. It can also be connected to an external Dolby Digital/MPEG2 decoder for 5.1 channel digital surround sound.

The new DVD player has an RRP of $3299. For more information contact Panasonic Customer Care on 132 600.

WHAT'S new in the ever-changing world of electronics

Chess set has conversational, teaching skills too

If you've ever wanted to master the finer skills of chess, then you need the Voice Master Talking Chess Set from Dick Smith Electronics — which has an interactive voice teaching feature and a sensory board.

The teaching feature can be set on two different levels. On the first level, the computer explains where each piece is legally allowed to move on the board. The second level takes it a step further and explains when a player makes a poor move and the possible consequences of each move.

The Talking Chess Set can be set for five different styles of play and has 4000 moves built into the machine's memory. It has a large LCD display and volume control. Plus, if you want to learn how to play like the pros, there are 40 famous

chess games played by past and present masters, already programmed into the computer.

Players can also play against the clock if desired and can even take back a move. It runs on four AA-size batteries (not included) and is compact enough to easily take on holidays when there's time to learn a new skill.

The Voice Master Talking Chess Set is available from Dick Smith Electronics Australia-Wide and DSE's Powerhouse stores at Penrith, Bankstown, Moore Park and Carnegie, for a retail price of $99 or via mail order by calling DSE Direct Link on 1300 366 644.

Olympus enhances photo printer

The new P-330E dye-sublimation digital printer from Olympus builds on the earlier P-300 by providing printing direct from SmartMedia cards or video. Its 'photorealistic quality' A6 prints (100 x 140mm) are claimed equivalent to 2400dpi from an inkjet, with 16.7 million colours. It's priced at $999 (RRP).

Compact DV camera has colour LCD monitor

Panasonic's newest digital video camera fits literally into the palm of your hand. The NV-DS33ENA is claimed as the world's smallest palm-style digital video camera to incorporate an LCD monitor.

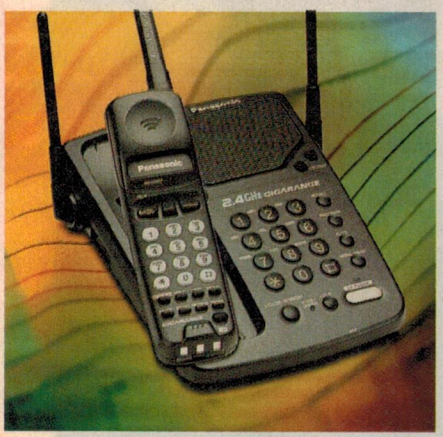
The new model is easy and light to hold and operate, at just 123mm long and 58mm wide, and weighing only 510g. The generous size of the video camera's controls gives the user confidence in operating them without taking their eye from the viewfinder.

The DS33 has the same high-quality LCD screen used in Panasonic's semi-professional DV camera, the NV-DX100. The 2.5" (63.5mm) 180,000-pixel polycrystalline-silicon LCD screen has an extremely high horizontal resolution of 400 lines — providing a brilliant picture with sharp detail. New circuitry has also been designed to boost brightness and reduce power consumption.

Other features include ultra high-quality stills with the Progressive Photo Shot feature; digital dubbing and editing via the i.LINK (IEEE 1394) I/O terminal; PC connectivity; image editing software; variable speed search; digital effects; 10x optical and 20x/100x digital zoom; and a Super Image Stabiliser.

The DS33 has an RRP of $4099 and is available from leading retailers. For more information contact Panasonic Customer Care on 132 600.

New Panasonic phones use SST, UHF



Panasonic's latest cordless phones — the KXTG210AL-B and the KXTG200AL-B — are claimed as the first telephones on the Australian market to take advantage of the powerful 2.4GHz (gigahertz) UHF band, providing outstanding reliability in range and sound quality. The phones are the first in Panasonic's line of 'Gigarange' products, which incorporate 2.4GHz spread spectrum technology (SST).

The new models transmit on two separate frequency bands (2.4GHz on the base, 900MHz on the handset) for reliable range and clear conversations with virtually no echo. Panasonic says its circuitry includes a 'protective shield' that significantly reduces interference from other devices using the 2.4GHz band.

Others features include a dual antenna system where one antenna is used for transmitting and the other for receiving, ensuring smooth, continuous two-way conversations; and Smart Channel Select, which automatically searches all 24 channels when the talk button is engaged, and switches to the clearest one.

The phones incorporate a high-capacity nickel metal hydride (NiMH) battery, which offers up to six hours talk time and up to 14 days standby. The KXTG210AL-B has a dual keypad with base speakerphone, while the KXTG200AL-B has a keypad on the handset only. Both phones have a headset jack and belt clip, enabling connection of an optional headset for hands-free conversations.

The KXTG210AL-B has an RRP of $449 while the KXTG200AL-B is $369 RRP. For more information contact Panasonic's Customer Care Centre on 132 600.

New compact digicam from Olympus

Olympus says its new Camedia C-830L compact digital camera combines feature and performance enhancements with a breakthrough price tag for a 1.3 megapixel camera, building on the success of their earlier C-840L model.

The C-830L uses an improved version of the earlier C-840L's 1/2.7" CCD, with 1.3 million pixels. This is combined with an Olympus 5.5mm f/2.8 five element lens to ensure a sharp, detailed image and accurate colour reproduction.

The C-830L records images on 3.3V SmartMedia cards holding up to 16MB of data. A 4MB card is included with the camera.

Optional function cards are available to make digital imaging even more fun. Along with the Calendar Card and Template Card, there is a Handwriting Title Card to superimpose handwritten notes or drawings on an image.

The C-830L's new Noncompression SHQ Mode means there is no loss of image quality due to compression artifacts. To balance quality and storage requirements, digital photographers can now choose from four Quality Modes: Noncompression SHQ, SHQ, HQ, and SQ. The 4MB SmartMedia card supplied can hold at least 60 shots in the SQ Mode, 18 in the HQ Mode, nine in the SHQ Mode and one in the Noncompression SHQ Mode.

Another nice feature is a Video I/O terminal, offering the ability to view images directly on a standard PAL TV monitor, using the included video cable.

The Olympus Camedia C-830L is available from good photographic, computer and duty free stores across Australia for an RRP of $999.00. For more information contact distributor R. Gunz (Photographic), Locked Bag 690, Beaconsfield 2014.

More Megapixel Cameras from Kodak

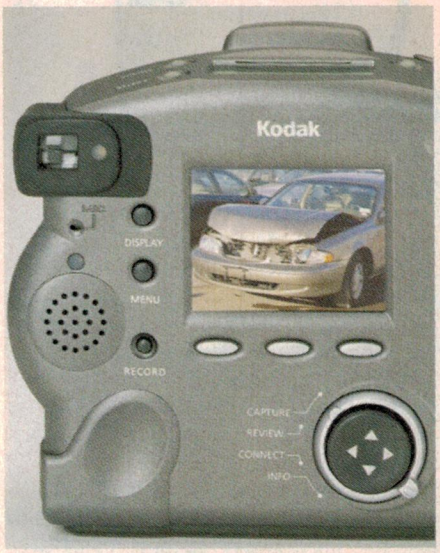
While Kodak may not offer the ultimate-performance digital still cameras, its models frequently offer excellent value for money — and tend to lead the market in this respect. Here's a look at the current megapixel models which Kodak released in April.

by Charles Gomer

IT SEEMS THE name of the game in today's digital camera marketing is "If you can't beat 'em, at least try to match the prices". Talk to most camera makers and the same story evolves: when Kodak launches a new range of digital cameras, the feature list increases while the price to the consumer falls; and the moment Kodak moves, the others follow suit.

This is exactly what happened when Kodak introduced three new cameras in April this year: the DC200 Plus model is a $849 camera with a one-megapixel CCD; the DC240 has a 1.3-megapixel CCD and costs $1499; the top of the consumer camera range is the DC265, a 1.6-megapixel CCD and a price tag of $1999. These are RRP prices, by the way, not street.

It would appear the only game in which other digital camera manufacturers can edge Kodak out of the running at present is in the pixel stakes. In simple terms, a higher pixel density CCD is able to capture a higher resolution image.



The operating side of the DC265, showing the 2" TFT LCD viewing screen and controls. At top is the front view.

The target for late 1998 was to produce cameras of 1,500,000 pixels (or 1.5 megapixels); now it would appear the mark to aim for is two megapixels. Already, Sony, Nikon, Olympus, Toshiba, Fuji and Ricoh have launched such models. A digital image of two million pixels will present sufficient quality to surpass a traditional film print of 100 x 150mm dimensions and, to less critical eyes, easily enable the making of a 200 x 250mm (8 x 10") inkjet print.

As to when digital cameras will begin to eat into the market sector occupied by traditional silver halide cameras, this depends on when makers can offer two-megapixel models at prices less than $1000. That's the day to look for. And the day to sell your shares in any company still staying with silver photography!

In relative terms the three Kodak cameras under discussion here are, in comparative terms, chalk, cheese and Chardonnay. Let's look at how they stack up...

DC200 Plus

The DC200 Plus is a basic model offering fixed focus and all the usual niceties, beginning with auto exposure (with exposure lock) and auto flash. But no zoom. The CCD delivers a 1152 x 864 pixel image. Probably an ideal family or school camera.

The DC240

The DC240 steps up a little by supplying auto focus plus a 3X optical zoom lens, augmented by a digital 2X boost — really an in-camera interpolation task, better done (in this reviewer's opinion) with software after downloading.

With this camera you get auto and manual exposure over-ride, adjustable to two stops up or down in half-stop increments. The camera has a fast powerup (less than 2.5 seconds), a swift shutter response and takes less than half a second between shots.

The DC265

Replacing the earlier DC260 model and costing a few hundred dollars more, the DC265 takes digital photography to near-pro heights. Which makes this camera a useable tool, if not for commercial photography *per se*, at least in business applications such as company images for reports, real estate purposes and retail uses. 200 x 250mm prints from this camera are, when viewed by most people, indistinguishable from traditional silver halide prints.

The camera has a significantly fast boot-up time and rapid processing between shots, unlike many cameras currently on the market.

Burst capture is a strong point of the DC265: six full size (1.6-megapixel) images, six SVGA (0.8-megapixel) images or 24 standard size (0.36-megapixel) images can be taken in one run. These are selectable at frame rates varying from one to three frames per second.

Time lapse is also possible: the camera can be set to fire off frames over predetermined intervals.

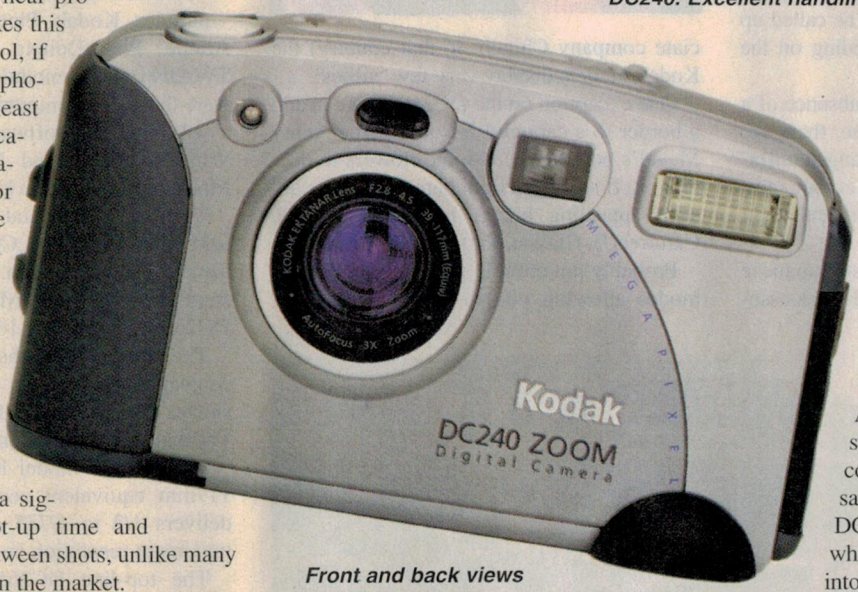
For discriminating users, the DC265 also offers a fourth — and lesser — level of compression ('Super'), which offers a lower compression ratio and higher quality than the Best setting.

Like the DC240, the Kodak DC265 3X optical zoom has a 2X digital boost function — useful to some, but still relying on simple interpolation, meaning no more real image information. A welcome addition is a flash synch feature, allowing the user to connect an external flash in the same way as a pro camera. The DC265 also has an albuming feature, which helps users organise images into 'digital photo albums.'

The new model offers a focus range from 0.3m to infinity. In addition, the DC265 features the ability to customise camera operations through the Flashpoint Digita operating environment, using Digita Script software. Scripting capabilities allow users to pre-program settings and camera operation, and to customise info tags for each image.

Audio input and playback is provided, letting users record sound with their images. A video outlet is on camera so users can view their pictures on TV.

The traditional bowl-of-fruit shot, taken in this case with the DC240. Excellent handling, not only of colour range but extreme contrasts.



Front and back views of the new DC240. Maximum image resolution of this model is 1280 x 960 pixels.

In the hand

Some time was spent with the DC240 camera and a series of test shots was taken.

The DC240 will win many hearts — and pockets — because of its size and capable

A shot of a puppet's head taken with the DC240, with one of its built-in borders — in this case 'Party'.

1.3-million pixel CCD. For such a (comparatively) reasonably priced digital camera, it offers a number of sophisticated features as well as (in my opinion) frippery.

The usefuls: Metering can be accomplished with either a multi-pattern setting applicable to general shooting or (a near-imperative for subjects against extremely dark or light backgrounds) a centre-weighted system.

Macro setting allows close up shooting in range extending from 250 to 500mm.

There are image sharpening and softening functions built into the camera. These can be useful if you are sending finished images direct from a shoot to perhaps an Internet site.

The camera's previewing aids are extensive: you can view the images full size on screen or as three scrollable thumbnail representations across the screen's lower edge. A useful 2X enlargement view can be called up — this can be useful when deciding on the need for a reshoot.

One could find fault with the absence of a manual white balance mode; true, there are four choices — auto, daylight, tungsten, fluorescent. But no method to set colour temperature when you're beneath difficult light such as sodium lamps.

The fripperies: Against most Japanese trends (the cameras are made by Kodak associate company Chinon, in that country) the Kodak models display very few 'sillies'.

One exception on the DC240: you can add a border to a captured image. Maybe Aunty Mabel's portrait needs some flowers to decorate it. If so, apply right here. And there are such appealing border effects as Award, Carefree(!), Classic, Party and more.

Probably not entirely useless is a series of modes allowing you to shoot in mono or sepia — or document, a method enhancing the capture of text in extreme contrast.

It would seem that, overall, the DC240 is a model that will find many devotees. It is simple to operate, light and relatively small. And its pictures compare with any produced by similarly priced models on the market. And that's what it's all about...

This internal shot in the local municipal library was taken with the DC240 using the existing soft lighting. Detail is retained, as you can see.

Comparative specs

All cameras use a CompactFlash card for image and employ JPEG compression, selectable at various levels, resulting in native format file sizes varying between 70-330KB. Saved as a JPEG image a typical picture will finish as a 300-600KB file; taken further, this image can be saved as a 3MB-plus TIFF file. The DC200 Plus and DC240 have CCD sensors rated at ISO 140, while the DC265 has an ISO 100 CCD.

The interface for each camera is serial, while some models offer USB connectivity and video output. The DC265 offers IrDA camera-to-PC links for data transfer.

Bundled software, depending on model, includes Kodak Picture Easy software, Adobe PhotoDeluxe and PageMill, a TWAIN acquire module, and mounter software that lets a computer view the camera as a disk drive. The software is compatible with Windows 95/98 and NT4.0. An optional Macintosh connection kit is also available.

The DC200 Plus and DC240 models each have a 1.8-inch TFT LCD screen; the DC265 camera has a 2" screen. The former pair are supplied with an 8MB card, while the DC265 is sold with a 16MB card.

The DC200 Plus has an f4-13.5/29mm equivalent (to a 35mm SLR) zoom lens. Its shutter delivers 1/2 to 1/362 second speeds. The maximum resolution is 1152 x 864 pixels.

The DC240 model has an f2.8-25.7/39-117mm equivalent zoom lens. Its shutter delivers 1/2 to 1/755 second speeds. The maximum resolution is 1280 x 960 pixels.

The top-line DC265 has an f3-14/38-115mm equivalent zoom lens. Its shutter delivers 1/4 to 1/400 second speeds. The maximum resolution is 1536 x 1024 pixels.

Note: the DC265's image ratio is 1.5 to 1, matching that of 35mm film — and rare amongst consumer digital cameras on the market, although Fuji recently introduced a its MX-2700 2-million-pixel camera with an 1800 x 1200 pixel CCD.

Final roundup

Kodak's new digital cameras follow the established model release pattern for the company. The DC240 will ideally service many business and personal users, while the DC265 — mainly because of price and capabilities — will reach the lower levels of pro photographers. ❖

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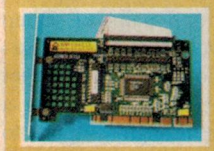

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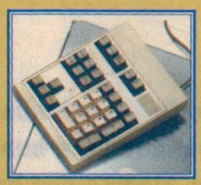

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Minimum-hassle surround sound:

Pioneer's HTV-1 'Simple Solution'

Many people would love to experience the impact of surround sound, but are turned off by the prospect of also being surrounded by a bunch of intimidating speaker boxes — or simply don't have the room for them. Pioneer Electronics has come up with a very interesting product which they're promoting as a 'simple solution' to this problem: the HTV-1 'Virtual Surround' system.

by Jim Rowe

THERE'S NO DOUBT that a modern home theatre system with a big screen and a 'no holds barred' surround sound setup can be very impressive, doing a surprisingly good job of presenting movies as they were meant to be experienced, in a cinema. But not everyone wants to be surrounded by an array of fairly conspicuous speaker boxes — even if they *do* have the room to fit them in. There's also the hassle of multi-channel amplifiers, hooking it all up and adjusting channel balance, time delay and so on.

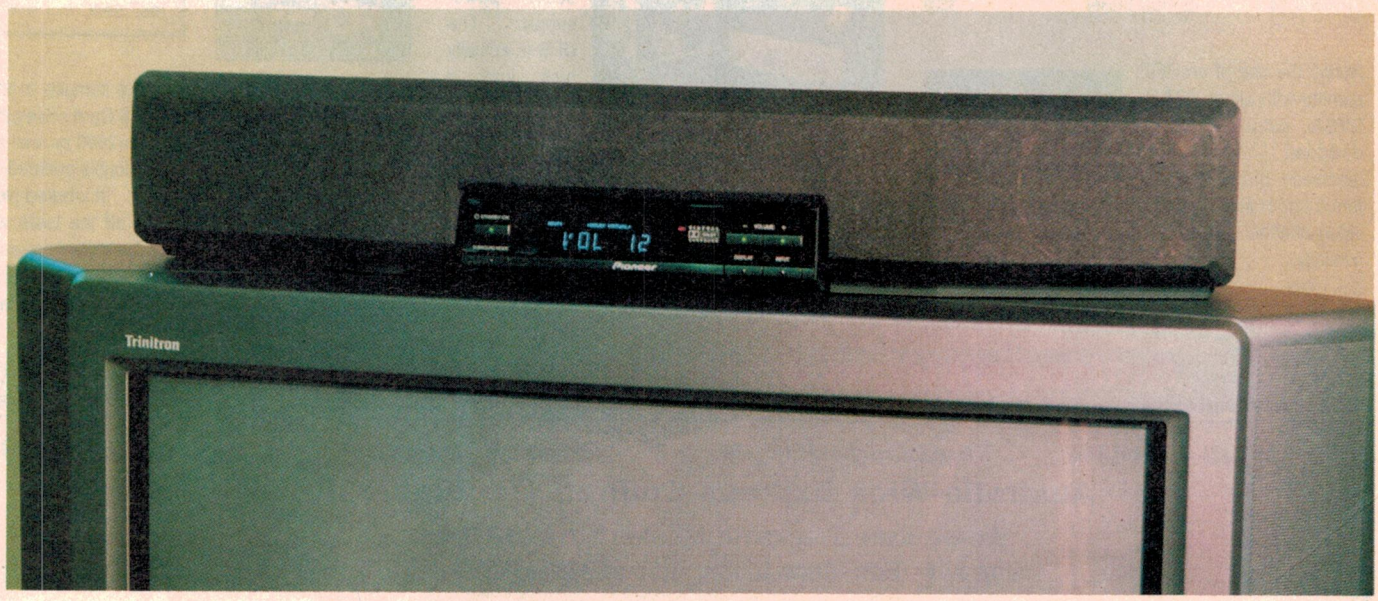
I suspect it's these considerations that have held back quite a few people from getting involved in home theatre and surround sound, until now. Most of the hardware manufacturers are well aware of the problem, too, because they've clearly been working either to develop much smaller and less obvious 'big sound' speaker systems, and/or alternative approaches which might still recreate an acceptable surround sound field, without needing as many speakers and complication.

Pioneer's new HTV-1 'Simple Solution' Home Theatre Sound System is essentially in the latter category, representing an interesting approach to hassle-free surround sound. It consists of only two main boxes: a low profile 'control centre' which sits on the top of your TV like an elongated set-top box, and a compact cube-shaped active subwoofer box which can be tucked down alongside the set, or over in a corner out of sight. The set-top control box measures a modest 610 x 110 x 166mm (W x H x D), while the active subwoofer is only 364 x 360 x 371mm — little more than a cubic foot, in old money.

The two boxes are linked by a pair of inconspicuous cables, and virtually all functions are controlled by a multifunction programmable/learning IR remote which can also be used to control your TV, VCR, DVD player, CD or Laserdisc player, as a bonus.

The only other connections to the HTV-1 system are for power and audio input. The active subwoofer box has a standard mains cord which supplies power for the complete system, while at the rear of the set-top control centre there are two pairs of stereo audio inputs (line level), to allow convenient selection of audio from two different sources. Each pair of inputs even has a matching pair of 'loop through' outputs, to make it really easy to connect the HTV-1 into existing systems.

So what Pioneer has achieved with the HTV-1 is produce a surprisingly compact system which effectively replaces the complete multi-channel power amplifier and speaker setup of a 'conventional' surround



sound system, with far fewer boxes and cables, and much simpler setup. But how can such a two-box system generate satisfying wide-range sound, let alone *surround* sound? By pulling a few nifty technical tricks, that's how.

For a start, the HTV-1 clearly adopts the satellite/subwoofer approach, where the non-directional bass frequencies are all handled by the subwoofer — a sturdy looking 200mm roll-surround driver, facing downwards in what appears to be a bass reflex cabinet and driven by its own 60W (DIN) amplifier, integrated with the system's main power supply in a rear compartment of the bass box.

This allows the remaining middle and high frequencies, which *are* directional, to be handled by much smaller 'satellite' speakers in the set-top box — a pair of 87mm drivers, each in a very small ported compartment at either end of the nicely designed and light-but-sturdy ABS box. These speakers are driven by a pair of 30W (DIN) amplifiers in the same box, along with the rest of the electronics.

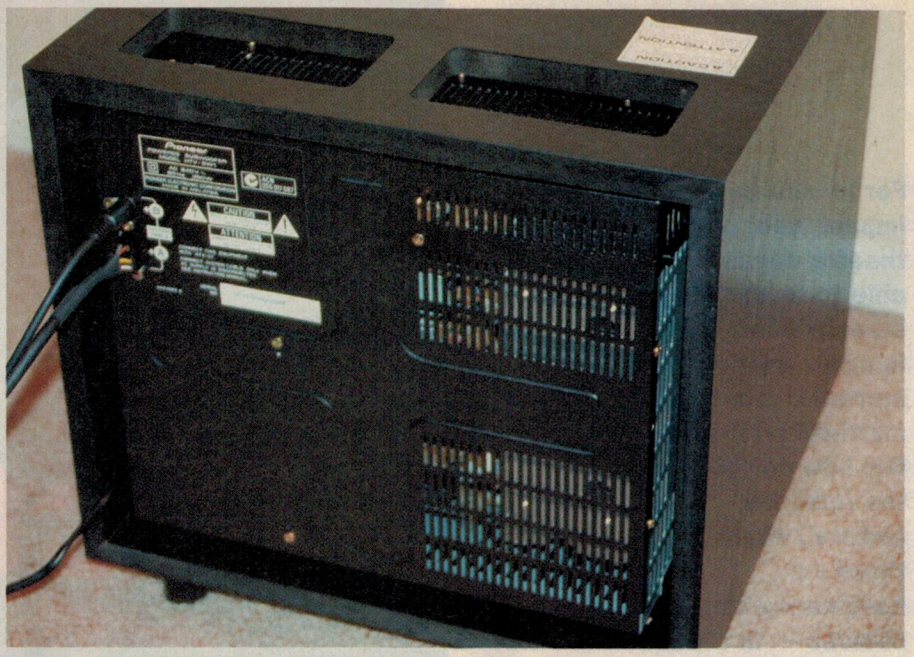
The crossover between the satellites and subwoofer seems to be at about 150Hz, and is quite smooth and 'transparent' so that the end result is well-balanced full-range reproduction.

To produce the surround sound, Pioneer pulls its other main technical trick: inside that set-top control unit, there's some pretty fancy digital signal processing (DSP) circuitry. This takes the incoming stereo audio and first implements standard Dolby Pro-Logic surround decoding, to produce 4.1 channels of 'enhanced analog' surround information. After the '0.1' LFE channel is extracted to send to the subwoofer amp, the remaining four channels are then passed through the second phase of DSP, which performs a Virtual Dolby Surround 'virtualising' operation. Here the four signals are processed and recombined with the right phase shifts and time delays to produce two final signals which, when amplified and fed to the two inbuilt satellite speakers, produce a sound field which seems to the ear as if it's coming from all around the room...

As the DSP circuitry neatly extracts the bass information for the subwoofer as part of the operation, it essentially performs the role of a crossover network digitally — avoiding the need for expensive and bulky passive crossover components.

Not surprisingly, perhaps, this fancy DSP circuitry is controlled by a built-in microprocessor, which gives you control over a wide range of functions (mainly via the remote). For example you can switch between stereo, stereo wide or Dolby Virtual Surround modes; control overall volume, bass and treble boost or cut, channel balance, subwoofer level, surround effect level; switch a Loudness filter in or out; select either of the two possible stereo input sources; or select from three different illumination levels for the inbuilt fluorescent status display (or turn it off altogether). Needless to say the remote also lets you turn the whole HTV-1 system on and off, as well.

So inside those compact and unassuming little boxes, Pioneer has packed a surprising amount of high-tech functionality — all directed towards the goal of achieving a convincing surround sound field, from far less hardware than you'd expect.



Here's the rear of the HTV-1's active subwoofer (above), showing how neat and user friendly it all is. Below is a peek at the driver and its reflexing port, on the bottom. The compact 'control centre' is shown on the opposite page, atop a TV set.

Trying it out

But of course the acid test is how well it all works. Does the HTV-1 produce a convincing surround sound effect? Happily we were able to try one out for a couple of weeks, to find this out for ourselves.

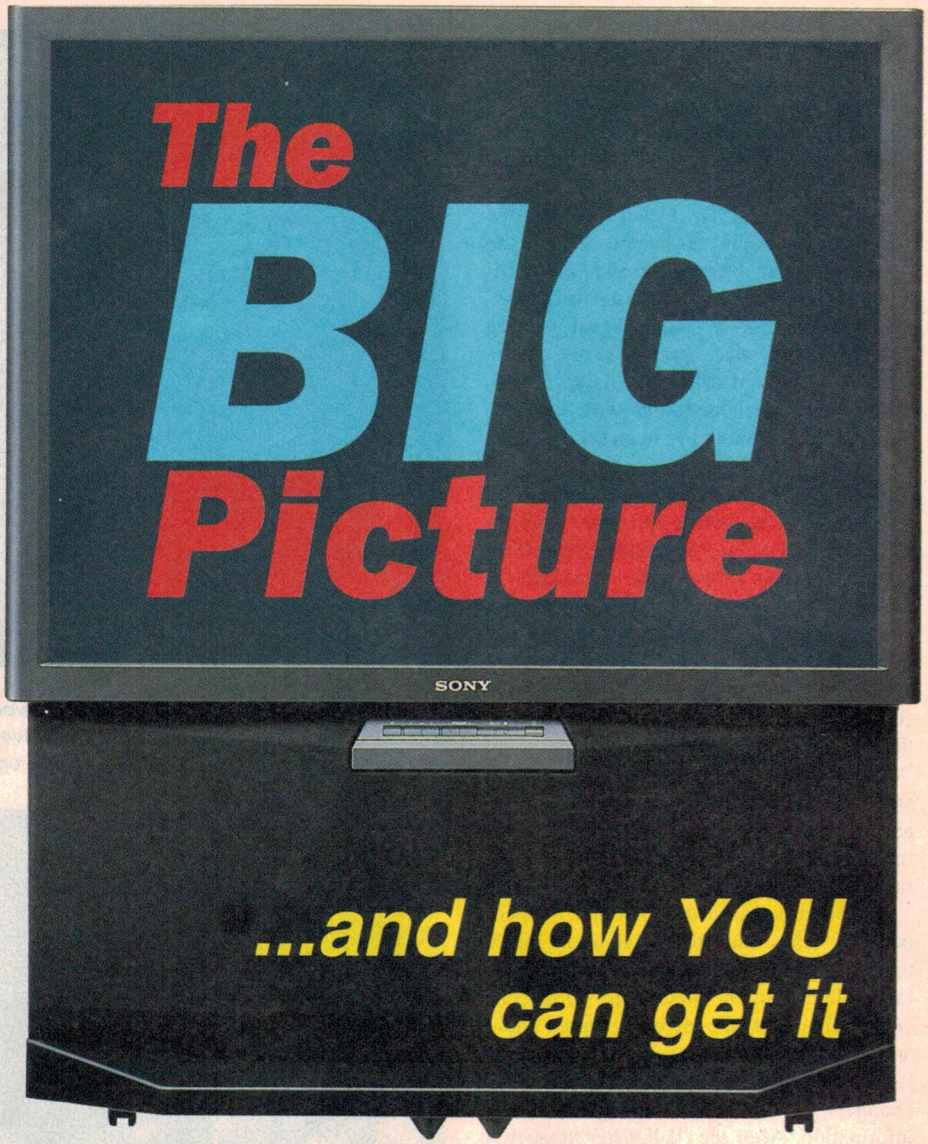
First we ran the instruments over the system — to the limited extent that you can, with such a tightly integrated setup. It wasn't possible to get frequency response or power output measurements, but the instruments did show an overall response that was reasonably smooth

(Continued on page 24)

The BIG Picture

...and how YOU can get it

For maximum impact, your home theatre needs to be able to display 'big screen' video images, as well as surround you with multi-channel sound. But how do you get the right 'big picture', when there's a bewildering array of choices — in terms of both technology and price? Here's a guide...



by Jim Rowe

WHEN IT COMES to the *picture* side of your home theatre setup, the basic rule of thumb you'll hear is 'the bigger the better'. It's basically true, too, even though it does over-simplify a fairly complicated situation — as you'll soon realise, if you look at the different kinds of 'big picture' video displays on offer at retailers.

You'll find large-screen conventional cathode ray tube-based TVs and monitors, much larger rear-projection sets, video projectors based on either liquid-crystal display (LCD), CRT or micromirror array technology, and flat-panel screens based on plasma technology. Each of these display technologies has its own strengths and benefits, along with its drawbacks; picking the right one for *you* can be surprisingly hard, especially if you're not up to speed on the various pros and cons.

That's the aim of this article: to give you a good basic grounding on each of the technologies currently available for displaying large video images, and their comparative strengths and weaknesses. Armed with this information, you'll hopefully be able to see the 'big picture' more clearly, and be in a much better position to choose the right kind of technology and product for your own particular needs.

Let's start with the video display device that most of us are most familiar with: the good old cathode-ray tube or 'CRT', as still used in the majority of TV sets and computer monitors.

Big-screen CRTs

The directly-viewed CRT has been used for displaying video images for over 50 years, and is the main example of 'valve technology' that's still being used in most of today's homes and offices. As used in your TV set or computer monitor to display colour pictures, it's essentially three valves in one — one for each of the three primary colours used to recreate the picture.

At the rear of the tube there's three electron guns, each firing a stream of high-energy electrons towards the front screen. Magnetic deflection coils are used to make the three beams 'scan' the screen in zig-zag fashion, to create a line-by-line image, while a metal masking system just behind the screen makes sure that each beam hits only the stripes or dots of the right phosphor powder on the back of the screen, to glow with the corresponding colour. The video signal to be displayed is split into the three colour components, which are used to vary the three electron beams so that they 'paint' the image details and colour gradations.

The CRT needs high voltage (typically at least 25,000 volts) and consumes a fair bit of power, but it's well-proven technology and still very hard to beat when you're considering picture brightness and clarity. After the tube is setup correctly during manufacture, it generally keeps on producing high quality images with little or no further adjustment.

A CRT also tends to be the most cost-effective display technology — that's why they're still used in the majority of TV sets and desktop computer monitors.

Of course there's a practical limit to the size you can make a CRT. It's still a glass 'bottle' containing a vacuum, which means that the flat or near-flat screen in particular has to be

made very strong to withstand the huge difference in pressure between the atmosphere outside, and the vacuum inside. The bigger and flatter the screen, the thicker (and heavier) the glass must be made. As the screen gets larger the high voltage supply must also be made huskier, to deliver sufficient beam current to maintain image brightness.

As a result, it's not really practical to make CRTs with screens larger than about 80-86cm (about 34"). By this size, the weight of the picture tube alone has become quite daunting.

A further drawback of CRTs is that because of the way they work, 'spraying' electron beams in zig-zag fashion to form the picture, it's hard for them to achieve an image that's completely undistorted in terms of geometry (i.e., truly circular circles, etc.), and even brightness and focus right to the corners. In that respect, CRTs aren't as good as the other technologies based on digital sampling and pixellised presentation (like LCDs, DLTs and plasma panels, which we'll discuss shortly).

Still, if your home theatre is in a relatively small room and a picture measuring 68cm or 80cm on the diagonal is large enough to give you much the same field of view as you get at your local cinema, a standard 'big screen' TV set with a directly viewed CRT really is very hard to beat. You'll get clear, very bright pictures, and at a cost that's significantly lower than virtually any of the other approaches. Even the top-line CRT based 80 - 86cm sets are generally below $4000, with 68cm models available for less than $1500.

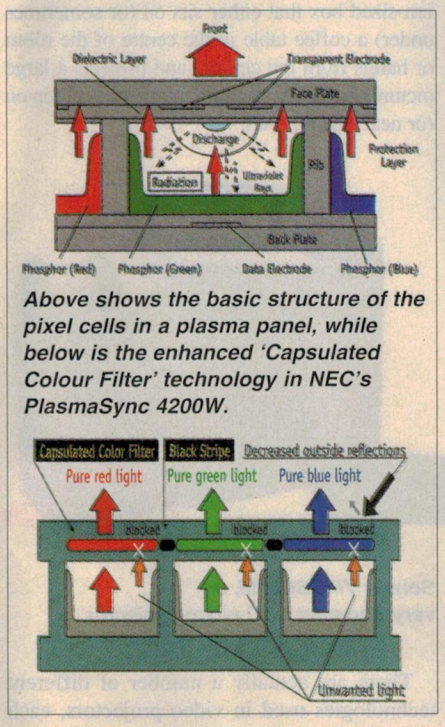
But what if your home theatre room is fairly large, and you want to be able to show your movies to more than 2-3 people — so you really need a picture somewhat larger than 86cm? Well, now you need to consider one of the alternative technologies. We'll now look at these in turn, working broadly upwards in terms of price.

Rear-projection sets

In many ways the next step up from a directly-viewed CRT set is a rear-projection TV. You'll have seen these at the larger department stores and audio-visual dealers; they're considerably larger, taller and more rectangular than conventional TV sets, with a completely flat glass or plastic screen filling the upper 2/3 or so of the front. The screen generally has corners that are 'square' rather than rounded, and many of them offer a 'widescreen' aspect ratio of 16x9 or so rather than the familiar 4x3.

As the name suggests, this type of set creates the larger image by means of optical rear projection inside the cabinet. Generally the image is still created on a CRT, or perhaps three of them — one for each colour. Either way, the CRT(s) may be relatively small (about 18cm, or 7"), but run from very high voltage (typically 32kV) so that it/they produce *very* bright images. Often they're water cooled, to prevent overheating. Then a system of wide-aperture lenses and very efficient mirrors are used to project these very bright small images onto the rear of the translucent main screen. Often the screen itself has a flat-profile 'Fresnel' lens moulded into its rear surface, to give more even illumination and stop the picture from having a 'hot spot' in the centre.

The basic image clarity achieved by this type of set is essentially still very close to that of a directly-viewed CRT set, although the optical magnification system does give a small reduction in image sharpness and introduce some additional distortion. But the main penalty is image brightness — when you optically magnify an image this way, its brightness inevitably drops, in a roughly square-law manner (i.e., double the size gives about one-quarter the brightness).



Above shows the basic structure of the pixel cells in a plasma panel, while below is the enhanced 'Capsulated Colour Filter' technology in NEC's PlasmaSync 4200W.

There's also an additional problem with rear-projection sets in terms of screen efficiency and reflection of ambient light. Not all of the light projected onto the rear of the screen reaches the front, while conversely some of the ambient light falling on the front tends to be reflected back into your eyes. So as well as reduced brightness, the picture *contrast ratio* tends to suffer if there's much ambient light level. In particular, the black part of the picture lightens to become only a dark grey.

So rear-projection sets tend to give the best picture in a darkened room, or one with at least subdued lighting. Of course that may not be a problem if you like watching your movies in the dark, as many people do...

Another possible disadvantage of rear-projection sets is that for some people, they tend to be a bit large and overpowering as a piece of furniture — especially in medium-sized rooms. Still, what's 'large and overpowering' for one person may well be 'big and impressive' to somebody else, so it's largely a matter of taste.

On the plus side, rear-projection sets are much the same as direct-view CRT sets when it comes to hassle-free viewing. There's still virtually nothing to set up; you simply turn them on and away they go.

The price is generally higher than for traditional direct-viewing CRT sets, but not drastically so. A good rear-projection set with a screen measuring about 130cm diagonally will typically set you back between $4500 and $6000.

Bigger lines, too

At this point, I should perhaps make a few general comments about what happens when you enlarge a standard-resolution PAL or NTSC video image (from say a VCR, DVD or Laserdisc player) to big-screen size.

The fact is that when you're viewing a standard resolution video image on a 68cm or smaller screen, at a typical viewing distance of two metres or so, you're generally not aware of its scanning line structure — the way it's composed of 625 interlaced horizontal lines (525 for NTSC). But once you enlarge the image to occupy more of your field of view, there comes a point where the individual lines become visible to your eye, rather than blending into a smooth image.

So whatever the technology you're using, simply blowing up the image size itself tends to make the line structure more visible — along with any other imperfections that may be present.

It's for this reason that some of the better large-screen sets and projectors incorporate special features like digital scan conversion 'line doubling' (giving you a synthesised high-resolution picture, with twice as many lines spaced more closely together); 'spot wobble' (scanning the lines in a fine 'zig-zag' fashion, so they thicken to make the gaps between them less visible); 100Hz field scanning (to reduce flicker); video comb filtering to reduce the heterodyne interference ('dot crawl' and 'Moire pattern') that can occur between high-frequency video (luminance) and chrominance (colour) information; beam-velocity modulation to improve video sharpness, and so on.

The larger the picture gets — or strictly, the larger it looms in your field of view — the more worthwhile these high-tech enhancements become. So if your budget allows, by all means go for a model with as many of these frills as possible; they certainly do improve the perceived picture quality and impact.

(The only warning here is that line doubling in particular can be disturbed by the Macrovision copy protection signals built into many of the latest video movies, especially those on DVDs. In an extreme case, you may not be able to get a stable picture.)

Choice of inputs

Just as the line structure becomes more evident when you enlarge a standard video image beyond a certain size, it's also true that any lack of sharpness (i.e., poor video bandwidth), edge distortion (overshoot and/or ringing), colour smear (timing errors) or other weaknesses in the video recording tend to be made more visible as well. And many of these problems tend to be more evident when the picture information is in the traditional 'composite video' form, with the luminance and colour information lumped together.

Composite video (CV) is the type you're probably most familiar with, where the video is conveyed via a single coaxial cable, fitted with either 'RCA' or 'BNC' connectors. Most domestic VCRs are fitted with this type of video input and output, and many modern TV sets fitted with direct 'AV' inputs provide only for this type of video input.

There are other video formats that tend to give better results than composite video, though, and these can make a noticeable difference — especially when you're showing the pictures on a big screen.

The next step up from composite video is 'S-Video' or Y/C video, where the luminance (Y) and chrominance (C) information are kept separate and carried on twin coaxial cables. This type of video generally uses miniature four-pin DIN plugs and sockets. Many high-end VCRs and Laserdisc players — and most DVD players — are able to supply video in this form as well as composite video.

Next step up again is 'component' or Y/B-Y/R-Y video, where the chrominance information is not only separated from the luminance, but also split into its two main components (B-Y and R-Y). This is actually the form in which video is digitised and stored on DVDs, and as a result it can give the best picture quality of all when you're playing a DVD. Provided, of course, that your DVD player provides component video outputs, and your big-screen set or projector is provided with the matching inputs...

So my advice is that when you're trying to choose a big-screen set or projector, make sure you consider what it provides in terms of video inputs — because the more options it provides, the better will be your chances of achieving the best possible image quality. Go for a set with all three types of input (CV, S-Video and component video) if possible, or failing that try to get one with at least S-Video as well as CV.

Now let's return to our survey of big-screen options.

Video projectors

Needless to say, there's again a limit to the size you can make a rear-projection TV — before the cabinet simply becomes too large and overpowering, and impossible to get into a typical room without pulling it apart and reassembling it again. So if you need an even larger picture than the 130cm or so of a rear-projection set, you'll generally need to consider a video front projector.

Front projectors (usually just called video projectors) basically work in much the same way as traditional slide and movie film projectors, projecting their image onto a screen from the 'front' (i.e., the same side of the screen as the viewers). They're generally a small to medium-sized box that either sits on (or sometimes under) a coffee table in the centre of the room or hangs from the ceiling, and projects a large picture on a fairly standard matt white screen on (or near) the far wall.

Sony's VPL-SC50M, a very compact LCD video projector.

There are actually a number of different technologies used in video projectors, each with its own strengths and weaknesses. We'll take a quick look at each one in turn, so you can put them into perspective.

Three-tube projectors

The first technology that was used for video projectors is the three-tube system, where three small CRTs (for the three primary colours) are mounted side by side in the box, with their screens facing the main screen via colour filters and matching large lenses. This type of projector is still quite popular, and you can always recognise them by their three large lens 'eyes', glowing red/green/blue and facing the screen.

Essentially this is the same technology used in rear-projection sets, except that the optical projection path is now 'unfolded' and there are no screen transmission losses. So as the picture is still being produced by CRTs, and there's a more efficient optical system, we now have the potential for excellent image brightness and quality.

On the other hand, because the projector and screen are now separate, we've also lost the advantages of a fixed optical setup. Before you can achieve the full image quality and start viewing, this kind of projector has to be carefully set up so that all three optical paths are accurately focussed on the screen, and with the three colour images precisely converged to form a clear colour picture. This can take a fair bit of fiddling around, so three-tube projectors are really only suitable for fixed 'permanent' installations — where you set them up, and then don't change anything.

Apart from that, the only other shortcoming of this type of projector is that their image brightness often isn't spectacular, even with the tubes fed with very high voltage and with fluid-cooled tubes and lenses. Typically it's between about 250 and 1000 lumens. As a result, three-tube projectors generally give the best results in a darkened room, especially when you're going for a *large* picture (say over about 2m diagonally).

That said, though, three-tube projectors probably still give the clearest and most satisfying pictures for home theatres, once you want a picture larger than is available from a rear-projection set. But be prepared for their considerably higher price (usually well over $15,000), and for the setup hassles.

LCD projectors

The next video projector technology to be developed was the LCD type, and this is nowadays the most popular kind of projector you'll see on offer. They're more compact than the three-tube type, and have a single main lens rather than three.

There are actually two different types of LCD projector, one which uses three LCD panels (one per primary colour) and the other a single LCD panel with striped colour filters. However while the latter approach is simpler and generally less costly, it also tends to deliver somewhat poorer images. As a result most LCD projectors currently available use the three-panel system, so we'll concentrate on that type.

Inside, there's a high intensity metal-halide, 'UHP' or high pressure mercury arc lamp, and a precision optical system that first filters and splits the lamp's output into the three primary colours. Then each colour beam is passed through its own LCD panel — roughly the same size as a 35mm colour slide, but with its image varying with the video signals. The three beams are then recombined via a precision optical prism block, and the resulting colour image passed through the main projection lens to focus on your screen.

The main advantage of this kind of projector are that they tend to have a high light output (usually well over 500 lumens, and up to 10 or 12 times that figure), and are able to produce very bright images. So they're good for producing images of 2.5m (diagonal) or more, even in typical ambient room lighting. Setup is also quite fast and straightforward, especially if the projector is fitted with a zoom lens; all that's required is zooming the image size to match your screen, and then setting the focus for best image clarity.

There is a penalty to be paid for this enhanced light output, though. Because an LCD panel is essentially an X-Y array of individual pixels, they're really better suited to projecting graphic images from a computer than handling video material. When the projector is displaying video, its internal processing circuitry has to convert the incoming video information into the corresponding array of discrete 'samples', each corresponding to a pixel dot in the LCD panel arrays.

A further complication is that the 'active' pixels in an LCD panel array tend to be separated by small dark lines (basically needed to make the connections to each row and column). As a result, an LCD image tends to have a 'dot structure' of its own (i.e., quite separate from the TV line structure), that's clearly visible when it's enlarged to full-screen size. Paradoxically this dot pattern tends to be more evident in LCDs offering high image resolution (like 'XGA' or 1024 x 768 pixels) than in those offering lower resolution (like 'SVGA' or 800 x 600 pixels), too.

It's not just a matter of being 'aware of the pixel dots', either. The LCD dot arrays tend to produce 'jaggy' edges on sloping lines in the image, which can be especially visible on fine detail. And when there's movement in the picture, as there usually is when you're watching a movie, the dot array also tends to cause its own brightness modulation — as the picture details 'move over the cracks' between pixels.

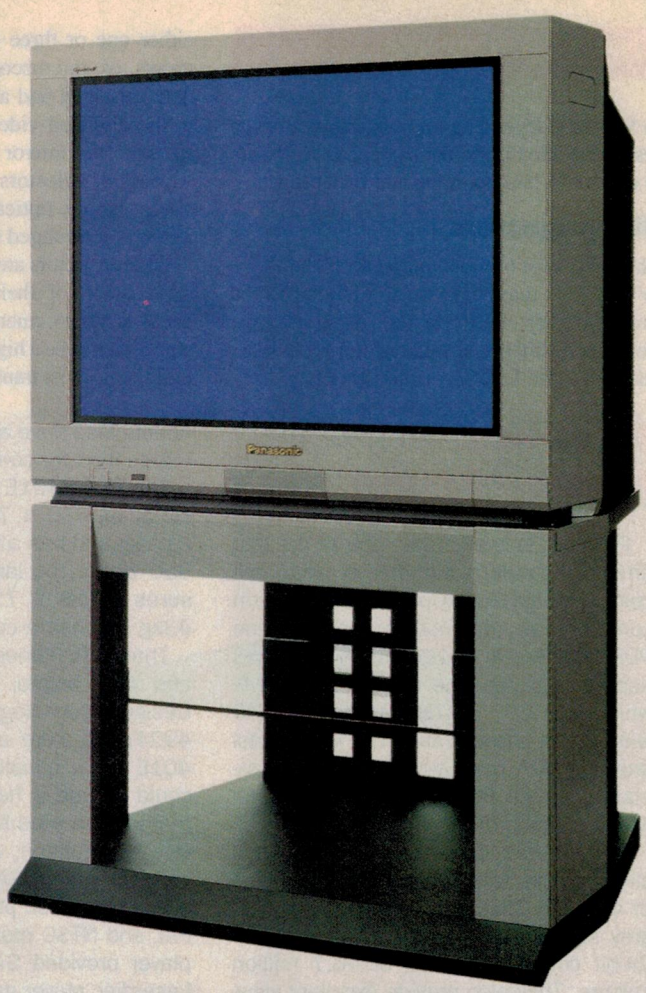
So even when their basic digital resolution is nominally more than sufficient to handle high-quality video (i.e., SVGA or better), the image produced by even the best LCD projectors still tends to be a little less satisfying than a CRT-based display device. Brighter, to be sure, but not quite as clear.

Another small drawback is that one way and another, there tends to be quite a lot of heat dissipated inside an LCD projector. As a result they're usually fitted with one or more cooling fans, and there can be quite a bit of fan noise...

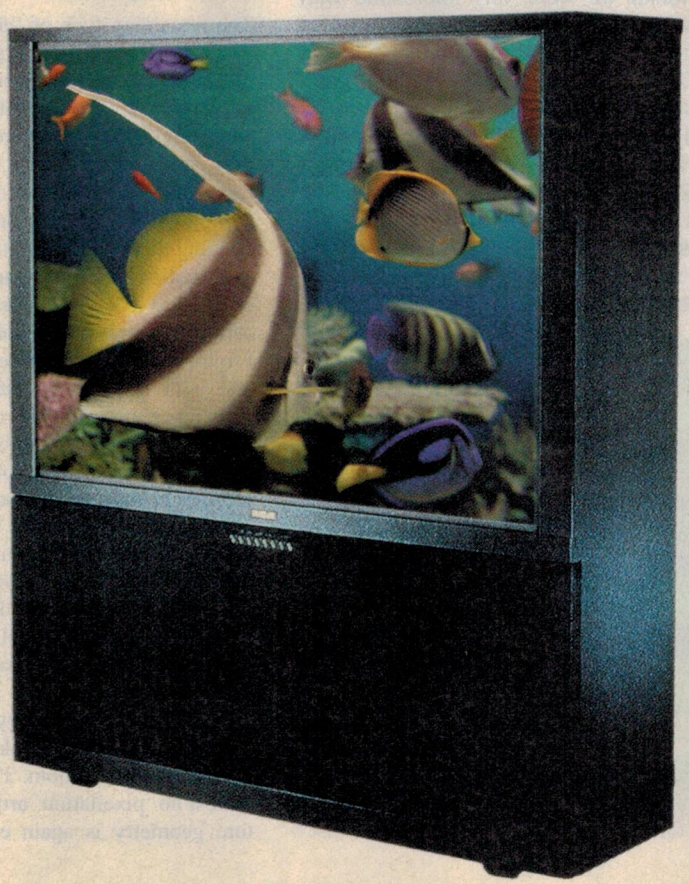
Still another shortcoming is that on the whole, LCD pixels are not super fast in reacting to rapid changes in signal level. This tends to cause a small amount of 'smear' on fast-moving images, although with top-quality projectors the effect is almost impossible to detect.

On the plus side, the pixellised X-Y array nature of an LCD projector's picture means that it's essentially perfect in terms of image geometry — circles remain circles, sloping lines remain straight and pixel clarity is essentially constant even into the corners.

On the whole, LCD projectors offer a very convenient way to produce big and bright pictures, even in rooms with typical indoor lighting levels. Their small physical size can also be very appealing, allowing them to 'put away in the cupboard' when they're not being used. Prices currently range from about $6000



A large CRT based set, Sony's KVXF34M31 uses the company's new Wega (pronounced 'vay-ga') flat-screen technology. Picture quality is excellent, for an RRP of $3469.



The RCA R46RG8JA, a rear-projection set offering a picture measuring 117cm (46") diagonally.

to $15,000, depending on light output, image resolution and things like motorised or manual control of lens zooming and focussing.

DLP projectors

The latest type of video projector technology to evolve is that based on the Digital Light Processing or 'DLP' system developed by Texas Instruments. Instead of the LCD panels used in an LCD projector, this type uses either one or three tiny chips forming X-Y arrays of microscopic mirrors, with each mirror hinged and able to move in response to the digitised video information. Needless to say the mirror arrays are essentially 'dynamic reflectors' rather than 'dynamic slides', so the optical system inside the projector is rearranged to suit.

DLP projectors are still quite new, and a full appreciation of their advantages and drawbacks is yet to emerge. However one advantage seems to be a higher optical efficiency that LCD projectors, translating into either brighter pictures or less heat (and fan noise), or both. Presumably that's because a micromirror array chip wastes less energy than an LCD panel. The tiny mirrors are apparently also faster to react than LCD pixels, giving less smear.

Although the DLP micromirror arrays still involve conversion of the incoming video signals into discrete pixel samples, it seems that the 'image pixellation' effect is somewhat less apparent than with LCD projectors. Presumably that's because a DLP array chips can be made with the tiny mirrors almost touching, so there's virtually no 'dark lines' between them. And because the image is an X-Y pixel array, like that of an LCD projector, picture geometry is again excellent.

As yet, most of the DLP projectors that have been produced seem to be high output (like 5000 - 6000 lumen) three-chip models for use in clubs, auditoriums and theatres, and with prices starting at about $20,000. However smaller single-chip models have started to appear, offering quite good light output (600 - 1000 lumens) and image quality.

In the USA, the InFocus firm has just released a very compact portable DLP projector, the LP330, measuring only 223 x 247 x 64mm and weighing only 2.18kg. With a resolution of 1024 x 768 pixels (XGA) and a light output of 650 lumens — very impressive for such a tiny unit — it perhaps provides a good indication of the potential of DLP technology. It's not cheap, though — US list price is $6999.

Plasma panels

The remaining type of 'big picture' display systems we need to look at are plasma panels. In their large full-colour form these have only been developed in the last couple of years, and they're easily recognised because they are generally quite thin — often no more than about 100mm deep. This makes them great for 'hanging on the wall', or suspending them just in front of one.

Essentially a plasma panel is a huge array of tiny gas-discharge cells (like tiny fluorescent tubes), with phosphors which glow brightly in one of the three primary colours and with columns of the different colour cells repeating cyclically over the screen — a bit like the phosphor stripes on a CRT screen. However instead of being scanned by electron beams, the cells are driven by an X-Y addressing system like that in an LCD or DLP projector panel. This means that for displaying video the incoming signals must again be converted into discrete pixel samples, but the discharge cells are very closely spaced and there are virtually no 'dark lines' between them.

The end result is a very bright, clear picture, which generally looks most impressive even in a well-lit room. There are generally almost no 'pixellation' artifacts, and the picture geometry is again essentially perfect.

Pioneer's Plasma Panels

Pioneer Electronics was one of the first firms to develop and market large full colour plasma display panels, and the firm currently has two models available: the PDP-V401E, a 40" (100cm) unit with 4x3 aspect ratio, and the newer PDP-501MX which is a 50" (127cm) unit with 16x9 widescreen aspect ratio. The 40" model provides VGA resolution (640 x 480 pixels), while the 50" model has enhanced XGA resolution of 1280 x 768 pixels.

Both panels provide very bright and clear images, with rated brightness levels of 400 and 350cd/m^2 (peak white), 8-bit grey scale resolution of 256 levels and 24-bit colour resolution of 16.7 million colours. They also provide excellent viewing over an exceptionally wide viewing angle (160° horizontally, 160° vertically) — a significant advantage over most projection-type displays.

Again both panels accept computer graphics input as well as video, and the 50" model even accepts Y/B-Y/R-Y component video input as well as the composite and S-Video inputs provided on the 40" model. In each case the panel automatically recognises and locks to either PAL or NTSC video formats. Both panels also have an RS-232C serial data information for configuration and control.

The PDP-V401E (pictured) has dimensions of 916 x 714 x 88mm, weighs 31.5kg and has a power consumption of 350 watts; the larger PDP-501MX measures 1218 x 714 x 98mm, weighs 43kg and has a consumption of 555W.

Thanks to Pioneer Electronics Australia and their helpful Sydney dealer Image Design Technology (phone (02) 9417 4924), we were able to try out a PDP-401E for a couple of days so that we could include a 'hands on' report for this feature. We tried it out in a typical home viewing situation, with signals from a PC graphics card (VGA mode), a DVD player and a Laserdisc player — providing both PAL and NTSC movie software. The DVD player provided S-Video drive, while the Laserdisc player gave composite video.

Frankly we were very impressed with both picture brightness and quality. Although in theory the PDP-401E's 640 x 480 pixel resolution isn't quite good enough for optimum presentation of DVD and Laserdisc video, the subjective image clarity was in fact excellent when viewed at 2m or more — and the pixellation artifacts significantly less than you get with most LCD projectors. It gave very satisfying viewing indeed, even when displaying widescreen movies in 'letterbox' mode. Although cooling fan noise was evident in quiet movie passages, it wasn't intrusive.

Needless to say the PDP-501MX with its higher resolution and widescreen aspect ratio should be even better again.

So the picture quality of these plasma panels is essentially top class. Your only problem is likely to be working out how you could afford one, at the RRP levels of $19,999 and $35,000 respectively. For more information contact Pioneer Electronics Australia.

The image quality of a CRT with the linearity of an LCD or DLP, in fact.

At this stage, though, plasma panels are only available in picture sizes up to about 127cm (50"). They're also very expensive, with 100cm (40") models typically costing around $17,000 and 127cm models between $19,000 and $30,000. This means they're of great interest to corporate users for boardroom and sales presentations, but probably a little beyond most of us, when it comes to our home theatre budget!

Closing comments

Hopefully this article will have given you at least a basic idea of the technology options currently available for producing 'big pictures' for your home theatre, and the main strengths and drawbacks of each.

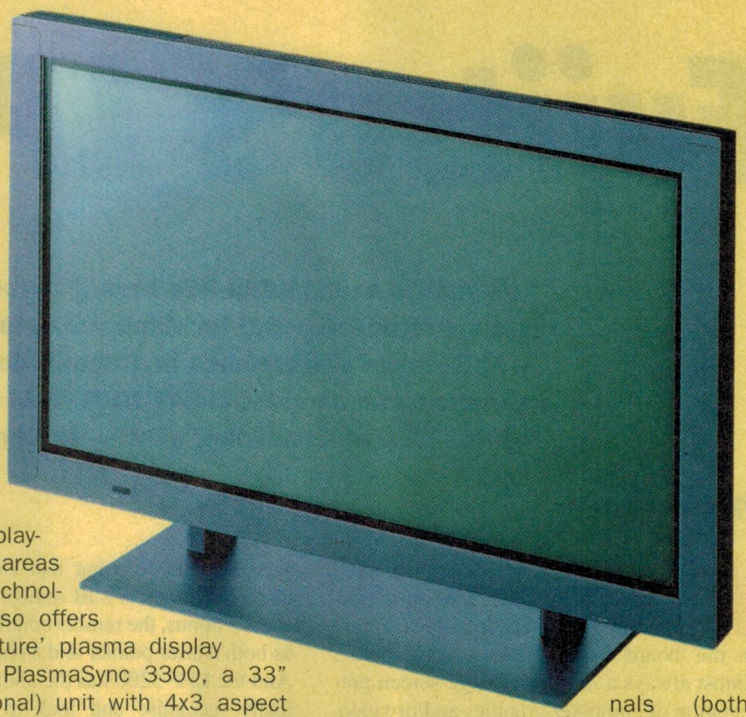
It can still be difficult to choose the right type and model for your particular needs, but now you'll perhaps have a better idea of what to look for, and what to expect in terms of performance and price level.

My best advice is that if you possibly can, get yourself a demonstration of the big picture options that seem most likely to be right for you. Most of the larger department stores and specialist home electronics stores should be able to show you examples of at least some of the products we've discussed in this article, operating in conditions close to those in a typical home theatre situation. That way, you'll be able to compare their strengths and limitations and be able to make a more confident buying decision.

For example one place where you'll be able to compare some of the products is in the Dick Smith Electronics 'PowerHouse' stores, currently located at Moore Park, Bankstown and Penrith in Sydney and Carnegie in Victoria. The PowerHouses all have Home Theatre demo rooms, and they can show you large-screen CRT sets, rear projection models and LCD projectors. Most of the large screen TVs are multistandard (PAL/NTSC), and there are several 100Hz models that are essentially 'flicker free'.

Brands of regular CRT sets in 68cm size and upwards include Sony, Panasonic, Grundig, TEAC, Sharp and JVC, and range in price from $1000 to $4000. The Powerhouse stores also stock rear projection models from Sony and Panasonic, ranging in price from $4000 to $6000, and four models of Sharp LCD projectors ranging in price from $4000 to $12,000. ❖

NEC's Plasma Panels



A leading player in most areas of display technology, NEC also offers two 'big picture' plasma display panels: the PlasmaSync 3300, a 33" (84cm diagonal) unit with 4x3 aspect ratio, and the PlasmaSync 4200W which is a 42" (107cm diagonal) unit with 16x9 widescreen aspect ratio. The 33" model provides VGA (640 x 480 pixel) resolution while the 42" model gives a resolution of 853 x 480 pixels.

Both models provide a very bright, clear display. The 3300 provides 6-bit (64 levels) grey scale and 18-bit (262,144 colours) colour reproduction, while the 4400 has 8-bit (256 levels) grey scale and 24-bit colour (16.7 million colours) reproduction. Both also accept computer graphics input as well as video, with the 3300 providing both S-Video and composite video inputs and the 4400 adding component video inputs as well.

The PlasmaSync 3300 measures 788 x 620 x 130mm (without stand), and weighs 30.5kg; the 4400 measures 1048 x 648 x 91mm (without stand) and weighs 42.0kg. A range of mounting brackets and stands are available for each panel.

Thanks to NEC Australia, we were able to borrow a PlasmaSync 4400W for a couple of days and try it out for this feature. We set it up in a typical home viewing situation, and fed it with S-Video signals (both PAL and NTSC, 4x3 and 'letterbox') from a DVD player and composite video from a Laserdisc player.

The results were most impressive, with a very bright and clear image which could be viewed easily over a wide angle. As with the other plasma screen we tried out, the picture clarity at 2m or so was subjectively much better than the nominal pixel resolution (here 853 x 480 pixels) would lead you to expect. The pixellation artifacts were very slight, giving pictures that were very comparable with a CRT in terms of brightness and clarity, and essentially 'perfect' in geometry.

The cooling fan noise was commendably low, too. Other aspects of the PlasmaSync we liked were the multiple-mode zoom facility, to expand standard 4x3 images to fill the screen, and the built-in stereo audio amplifiers. We also liked the (optional) very powerful 'LCD remote' with its ability to control DVD players, etc.

In short, a very nice big screen display indeed — but alas only for those with a fairly large budget, as the RRP is $19,250. For more information, contact NEC Australia on 131 632.

Hi res, high output video projector:

Fujitsu's LPF-5200

Nowadays even laptop PCs have XGA-resolution (1024 x 768) displays, and as a result there's a strong demand for video projectors offering this order of resolution as well, for optimimum performance in presentations. Fujitsu's new LPF-5200 combines true XGA resolution with an outstanding 1000 ANSI lumens of light output, making it very suitable for this kind of demanding work — and pretty impressive for home theatre use, as well.

by Jim Rowe

WHETHER YOU'RE making a sales presentation to a client, or an important proposal to senior management or the board of directors, today there's almost always a need for a large-screen presentation of computer graphics and/or video. And this kind of situation is pretty demanding, because as well as needing bright and sharp images in reasonably high ambient lighting conditions, you also need to be able to set up your equipment quickly and with a minimum of hassle.

Happily the latest breed of LCD video projectors is almost ideally suited for such applications. They're relatively compact and portable, they can provide very high image brightness and quality, and unlike the earlier three-CRT models they don't need any initial colour convergence or triple focusing. They are generally also capable of automatically adjusting to a wide range of computer graphics modes as well as multiple video standards. Couple such facilities with features like fast motorised zoom and focussing, and you have an extremely handy presentation tool.

The same features also tend to make LCD projectors quite well suited for home theatre use, too. While they're rather more expensive than rear-projection big screen sets, they're also able to provide you with a brighter and equally large (or even larger) picture, *without* the need for an overpoweringly large cabinet. And they're still significantly cheaper than plasma-based flat screen displays...

Fujitsu's new LPF-5200 projector is a good case in point. Measuring only 374 x 292 x 162mm and weighing 6.8kg, it combines true XGA (1024 x 768 pixel) graphics resolution with a light output of no less than 1000 ANSI lumens — enough to produce bright images of at least two or three metres in size (measured diagonally) even in a very well lit room. Fast setup is also assured by a high quality 1.6:1 zoom lens (47.6 - 76mm), with motorised zooming and focusing that can be adjusted using the projector's IR remote control.

As a bonus, the remote control also doubles as both a laser pointer and a computer mouse. And the LPF-5200 has the ability to automatically recognise and lock to virtually any computer graphics display format, including all standard Mac formats and SXGA (1280 x 1024 pixels) — which it transparently compresses to XGA. There's even a high density 15-pin outlet as well as a choice of two inputs, to allow a standard graphics monitor to be driven from the computer as well.

The projector's remote control, which also functions as a laser pointer and a computer mouse.

On the video side it provides an S-Video (Y/C) input as well as one for composite video (plus again a composite output), and again it will automatically recognise and lock to standard PAL, NTSC and Secam, as well as NTSC4.43, M-PAL and N-PAL. With NTSC there's even the ability to shrink the image vertically into the wide-screen aspect ratio of 16:9.

The LPF-5200's high resolution is achieved using three 33mm (1.3") diagonal polysilicon TFT (thin-film transistor) LCD panels, which employ micro lenses to achieve maximum optical efficiency. Each panel has a resolution of 1024 x 768 pixels, giving a total image resolution of 2,359,296 pixels.

The light source is essentially the same 120W UHP lamp used in many of the latest projectors, which makes Fujitsu's achievement in attaining 1000 ANSI lumens of output and with a contrast ratio of over 250:1 all the more impressive. Presumably those microlens arrays on the LCD panels are part of the secret, together with the generous working aperture of the main projection lens — which varies from f/2.5 at the wide end to f/3.5 at the tele end. The end result is a projector able to produce exceptionally bright and evenly-lit images from 20" to 300" inches diagonal, at throws from 700mm up to 17.6m.

Needless to say there's an impressive array of input and output connectors. At the rear there are two high density 15-pin DB sockets giving a choice of two computer RGB computer graphics sources (selectable via either the top panel or the remote), plus a third output socket to provide a buffered version of the selected input for driving another display. Then there's an S-Video input and a composite video input, plus a buffered composite output for driving another monitor — very thoughtful.

As the projector is designed primarily for presentation work, it also includes an inbuilt 2

x 1W stereo amplifier driving a pair of small speakers (about 35mm) built inside the front of the case. And to match the various video inputs there are three corresponding pairs of stereo audio inputs, selected automatically when the video sources are selected — plus a pair of buffered audio outputs as well.

To allow the LPF-5200's remote to be used conveniently from either the front or back, there are IR sensors at both ends of the case. And for when the remote is used as a cordless mouse, with the projector hooked up to a computer, there are two sockets on the side for connecting the projector to the computer's normal mouse input. A range of mouse cables are supplied, to hook it up to either PCs or Macs in the various configurations.

(Also supplied are various cables and adaptors for the connection to the computer's video card — including an adaptor for Macs, with a DIP switch to set the 'monitor size'.)

The remote control itself is pretty impressive, with its built-in laser pointer as well as a large multi-way tilting circular button and smaller buttons for the mouse functions. It can also be used to remotely adjust focus, zooming and sound volume, as well as selecting the video source and even being able to mute either sound or image, and control digital zoom/pan for closeups of computer graphics.

Other nice features of the LPF-5200 include automatic retraction of the projection lens into the case when the power is turned off, to minimise the risk of transit damage; automatic operation of the cooling fan for two minutes after the projector is nominally turned off, to prevent overheating and minimise thermal shock; full on-screen display of all functions, feature settings and status indications, with automatic time-out removal of these displays after a few seconds; inbuilt on-screen target patterns to facilitate image focus and zoom adjustment; built-in monitoring of projection lamp operating hours, with an on-screen warning when the recommended end of lamp life is approaching; a set of status and diagnostic indicators on the front of the case, to warn of faults or excessive temperatures, etc.; and the ability to easily flip the projected image either laterally and/or vertically, to adapt the projector for either rear projection or 'suspended from the ceiling' applications.

In short, it's a projector with not only high resolution and exceptional light output,

Fujitsu LPF-5200 LCD Video Projector

A high performance true XGA resolution (1024 x 768 pixel) portable computer graphics/video projector offering 1000 ANSI lumen output, 250:1 contrast ratio, many functions and features.

***Good Points**: Excellent image quality, very high light output, fully motorised zoom and focus, plus DSP based magnification or reduction, compressed display of SXGA (1280 x 1024) graphics. Flexible remote also includes laser pointer and mouse functions.*

***Bad Points**: Only one minor gripe — at only 1m long, the main 'serial mouse' cable is a bit short.*

***RRP**: $12,529*

***Available**: Fujitsu General, 100 Holbeche Road, Arndell Park 2148; phone (02) 8822 2556.*

Fujitsu's LPF-5200

but a huge amount of flexibility and functions to boot.

Trying it out

We were able to try the sample LPF-5200 shown with a variety of video sources (DVD, Laserdisc, VCR and off-air), as well as with signals in a number of graphics modes (VGA, SVGA and XGA) from a Windows 98 PC. We also tried it producing a range of image sizes, from about 75cm up to about 2m, with both matt white and lenticular screens and in a range of lighting conditions.

Frankly we were most impressed with the images it produced, not only in terms of brightness — which was indeed exceptional — but also with its even illumination, right out to the corners. The modest degree of image pixilation was also quite impressive, with commendably small inter-pixel dark strips considering the 1024 x 768 resolution.

Adjusting the image size and optimising focus also turned out to be very fast and easy, thanks to the motorised functions and on-screen targets.

On the whole it was a very convenient projector to set up and give a presentation, whether from a computer or video source, and the image quality is certainly of a very high standard. About the only (minor) hassle we had was hooking up the LPF-5200's mouse output to the PS/2 mouse socket of the PC we were using, using the cables supplied. The main 'serial mouse cable' is only 1m long, with the PS/2 adaptor much shorter again; together they were still too short. Frankly we'd like to see the main cable about 2m long.

At the rear of the projector, there are 'loop through' outputs from not only the 15-pin computer graphics inputs but also the composite video and stereo audio inputs — very thoughtful!

Overall, though, the Fujitsu LPF-5200 is one very impressive video projector. At the price it's probably not likely to be within the budget of most of us for use as a dedicated home theatre projector, but it should be very easy to justify for top-notch sales and other corporate presentations. ❖

Pioneer HTV-1

(Continued from page 15)

and balanced, with a low-end rolloff at about 40Hz and an effective high-end rolloff at about 15-16kHz. There was also more than enough undistorted output to produce very convincing home theatre sound levels in a typical large home entertainment room.

For our main listening tests we tried the HTV-1 out with a good CD player, a DVD player and a Laserdisc player, and with a variety of music and movie software in order to get a good feel for its capabilities. For some of the tests we were even able to combine it with the Fujitsu LPF-5200 LCD Projector reviewed elsewhere in this issue, to create a very impressive home theatre setup.

The bottom line? Frankly we were very impressed. Certainly there's a limit to just how much can be achieved using a 'virtual' surround sound system, but judged in this context the HTV-1 gave a very good account of itself.

Understandably it can't duplicate the dramatic impact of a full Dolby Digital 5.1 channel discrete surround sound setup, or even a Pro-Logic 4.1 channel system with the usual array of speakers, but with a lot of software it does give a very satisfying surround sound effect. You often find it hard to believe that the 'big' sound you're hearing is coming from that unassuming little set-top unit and compact subwoofer. Only at the very highest 'neighbour upsetting' output levels did we detect a hint of boxiness and audible distortion...

The matching remote can also control a variety of TVs, VCRs, DVD players, etc.

So although Pioneer doesn't seem to be pushing the HTV-1 as a high-end audiophile or home theatre system, or in fact anything other than a 'simple solution', our impression is that it actually provides an order of performance which many people would find entirely satisfying. Especially when you consider the system's compactness, ease of installation/setup and operating convenience — and of course the price.

With the HTV-1, Pioneer might well have provided the key and stimulus to enter the world of surround sound, for all of those people who until now have been put off by the hassle of multiple speakers and amplifiers. If you're in that group, it's well worth a listen. ❖

Pioneer HTV-1 Home Theatre Sound System

A very compact 'minimum hassle' surround sound system combining a satellite-subwoofer speaker system with Virtual Dolby Surround digital sound processing.

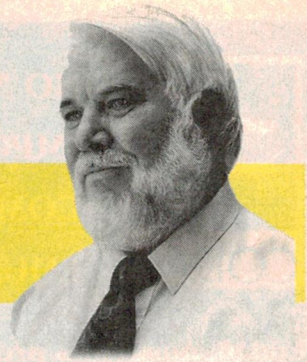
***Good Points**: Extremely easy to set up, with only a set-top control centre and a compact active subwoofer. Powerful pre-programmed/learning remote control allows full control of all system functions, as well as many functions of other components such as TVs, VCRs, DVD and Laserdisc players. Very satisfying level of 'big' sound, simulated surround effect.*

***Bad Points**: Nothing significant.*

***RRP**: $999*

***Available**: Pioneer dealers, or call Pioneer Electronics Australia on 1800 338 439.*

OPEN Fist



by Stewart Fist

The Brain Effects of EMFs

WHEN BIOMEDICAL scientists talk about laboratory studies on the possible effects of radio exposures, they usually mean using rats or mice (*in-vivo*, or 'in life') or possibly using cell cultures in petri dishes (*in vitro*, or 'in glass'). They rarely mean using human guinea pigs.

In fact, the cost of maintaining guinea pigs in large numbers these days is so prohibitive that the 'guinea pigs' are usually mice. There are, however, some exceptions.

We've just had a huge fuss made around the world about Alan Preece's study at Bristol University, UK, which showed a 4% improvement in reaction times among two groups of 18 students. He bombarded them with roughly 25 minutes of synthesised analog and GSM digital phone carriers waves, at handset power-density levels.

The participants sat in a room with a computerised display and logging device, and they were given a range of memory and reaction-time tasks. Transmitters were strapped to their left ear and fed with unmodulated analog carriers of the cellphone frequencies, and time-divided digital-type transmissions. Obviously, sometimes the power was on, and sometimes it was off — and the subjects didn't know.

Short-term memory tasks included looking at a range of images, then later identifying which they'd seen before, while the reaction-time tasks were of the punch-the-button-when-it-flashes type.

Preece found no significant change in his subjects for the memory tasks (one group has the added complication of alcohol and sleep deprivation), but quite consistent (although decidedly low-level) improvements in their reaction times.

The cellphone industry decided that this was the good news of the decade, and spread the word globally that Preece had proved cellphones, not only to be safe, but to be performance-enhancers.

Unfortunately a UK commentator named Alasdair Phillips unkindly pointed out that such substances as digitalis also stimulate immediate muscle-action when given in small doses, while they kill you in large doses or with prolonged exposures...

I've had a draft of the Preece report for some time, and frankly, I considered it to be so inconsequential that I hadn't bothered to write about it. Preece spoke about the research (then in the final stages) at a Florida conference in the middle of 1998, and said that he had found little of consequence. I agree.

I've had a draft of the Preece report for some time, and frankly, I considered it to be so inconsequential that I hadn't bothered to write about it

A good cup of coffee will give you performance enhancements of this order. With the group that was sleep deprived or given alcohol, it could be something to do with the temperature of the day, or the temperament of the subjects — perhaps boosted by the pleasures of the brief UK summer weather.

There have been a number of other studies of a similar kind, and many of them have been similarly reported by the press, whenever they show 'good results' from the industry's viewpoint. I find this happens with monotonous regularity in Europe (less so in America), to the point where you'd need to be naive not to believe there's a pattern to it all. Reuters and AAP appear to get industry press-releases mixed up with news reporting.

In May 1997 Reuters circulated a story that Finnish scientists had 'proved that cell phones were safe'. The story ran in all Australian newspapers with a headline paraphrasing the Reuters lead: 'Mobiles safe, study finds, but they do heat brain'.

It began with: 'A Finnish study partly funded by the telecommunications industry has found mobile phones pose no health threat to phone users, although they do transmit heat to people's brains, researchers said Thursday.'

'The study by four Finnish institutes examined the effect of radio frequencies used by mobile phones on the brains of 19 people and found no health hazards. The results are so consistent that the tests are completely sufficient, Maila Hietanen, researcher at the state-funded Occupational Health Institute told a news conference.'

It went on to completely confuse this EEG (electro-encephalogram) research on humans with an incomplete one by a totally different research group at another university, using mice. This group had not announced any findings or published any reports because their work was still in progress. (And two years later, I still haven't managed to get a copy!)

However at the time of the press conference, no unusual numbers of the exposed mice had died and this was announced. The e-mail I received when I asked for further information says: 'This was the final report on mortality, but more histopathological tests will be done in order to see if there are increased cases of any specific types of cancers.'

That was the origin of the 'mobiles safe' claim!

Contacted researcher

I was so intrigued by the Reuters reporting of the EEG story that I contacted Dr Maila Hietanen to ask how a Nokia-funded study on 19 university students could be 'completely sufficient' to prove cellphones were safe. Her reply gave me details of how the press conference was managed.

It transpired that she had only checked for brain-waves changes in students when a cellphone was switched on in the near vicinity. She was genuinely embarrassed at the misreporting, and concerned that such a misinterpretation of her work had been circulated globally.

"We had 19 volunteers, who were sitting relaxed, but not sleeping", she wrote. "The exposure was carried out by five various cellular phones, operated by remote control, so that the persons did not know when the phone was on and off (without any speech or other sound signal). EEG was recorded during real and sham exposure, and no statistically significant differences were found."

This was only one of half a dozen similar brain-waves studies done in the last few years around the world, and about half claim to detect slight effects (which the Preece study now tends to confirm) and half don't.

In 1997, the Finnish evidence was supported by another survey commissioned by the Deutschland Research Association for Radio Applications. Scientists from Germany's University in Bochum examined EEG traces with an eight-watt mobile phone kept 45cm away from the heads of their 52 subjects, to reduce the power densities to the approximate standard limits.

The results didn't show a significant brain-wave difference between the switched-on and switched-off (sham) tests. Under the same test conditions, the researchers also executed some undefined 'neuropsychological tests' and came to the conclusions that: 'Neither attention nor memory were influenced by electromagnetic waves'.

At the same time Drs Kim and Cho at the Hanyang University in South Korea used two groups in 10 healthy male volunteers — five subjects were users of cellular phones the other five were non-users. They watched the brain functions using an EEG and tested for auditory responses also when phones were switched on and off.

They found no significant difference for the alpha brainwaves, but a statistic difference for the 'short-latency audio evoked potential' wave ($p < 0.05$). This was said to be only a pilot trial, with full-scale research to be followed later, but I don't think it was ever done.

A year later in 1998, however, Dr Gabriele Freude reported in the research journal *Bioelectromagnetics* that mobile phone emissions certainly do influence human brain waves. A very interesting twist to this report was that the EEG changes were much more significant when the subject was occupied by an intellectual task.

At about the same time Dr Carsten Eulitz of the University of Konstanz reported support for this position in the *Neuroreport* journal (Oct 5 1998). His team looked at 13 healthy men in their twenties, who were asked to press a button when they heard a distinctive pattern of high-frequency tones in a series emitted every two seconds. A GSM mobile phone was mounted on the head and switched remotely, while the EEG readings were recorded.

They concluded that cell phones may affect brain activity, but that the effect was only noted when the brain was engaged in a set task. No effect was seen when the subjects listened to tones not related to the button-pushing task.

"This gives further evidence to the possibility that neural responses, as reflected in the EEG, can be modulated through radiation emitted by mobile phones", they said. And, well aware of previous misreporting, they wisely added: "This study does not allow us to determine any health risk, nor is it clear what behavioural consequences PEMF (pulsed high-frequency electromagnetic fields) exposure might have."

So the EEG research seems to be focussing on possible intellectual effects, rather than just neurological changes. But just when you think a pattern is emerging, other research upsets the apple-cart, once again.

German scientists Mann and Roschke found that there was REM (rapid eye movement sleep pattern) suppression induced by digital mobile radio telephones, back in 1996. They studied the effects of GSM digital mobiles on sleep in healthy humans and found a REM-suppressive effect, and a reduction in both the percentage of, and duration of, REM sleep.

Then a few months ago (May 1999) researchers at the Karolinska Institute in Sweden suggested that the changes from EMFs might occur mainly during sleep also. This may be linked to possible melatonin levels (now well documented) from nighttime pineal activity.

This report came from an electric-blanket study (but with temperature strictly controlled) which found that with a very low level (1uT) 50Hz electromagnetic field, sleep is impaired and the magnetic fields have a discernible effect on brain-waves.

Again, 18 subjects were used (this must be a magic number!) and they reported that those subjected to the magnetic field showed a reduction in total sleep time, and changes to the EEG slow-wave sleep patterns. However circulating melatonin and other key blood chemistry factors were not affected. ❖

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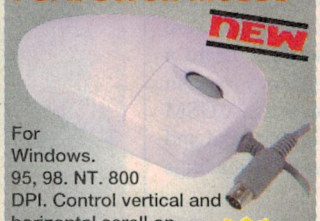

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- Holster included.

See 99 Cat. page 29. Cat. QM-1470

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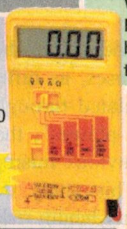

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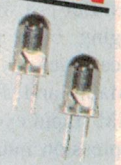

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RESPONSE Double Magnet Subwoofers

NEW

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The case: 4mm thick non pressed Coated Paper it can withstand huge excursions without flex or break up.

The magnets: 10" - Two 1.13Kg A total of 2.26Kg
12" - Two 1.41Kg A total of 2.82Kg

The basket: Thick heavy duty cast aluminium type with zero flex even under the most horrendous driving conditions. One feature of these Drivers is that they have dual voice coils and can be wired in a number of ways to make this driver extremely flexible. The backing plate: 19mm thick! (Average thickness in most woofers is 8-10mm). This gives fantastic linearity. Pole piece: Flared vent at the rear of the driver dramatically minimizes wind noise & increases air movement to cool the Voice Coil.

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"The Jaycar speaker surprised me a lot. Looking at its beefy business like construction, I expected it to sound big, brash and brassy. Instead it offered the smoothest most linear sound of the group. Even at low volume this sub still exhibited excellent warmth, weight and authority (exceeding many of the 15"s I've reviewed) but when fed lots of power the Jaycar speaker didn't lose any of its tonal accuracy or control, sounding just as balanced with the rest of the system as it did at low volume. Overall performance was exceptional."

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- Power: 250WRMS
- Sensitivity: 83.66dB 1w/1m (Ref)
- Sealed Box
- Box vol (litres): 35
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Cat. CS-2226

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- Power: 250WRMS
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- Box volume (litres): 50
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- -3dB Freq (Hz): 40
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- Size: A 312, B 295, C 283

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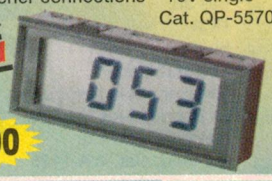

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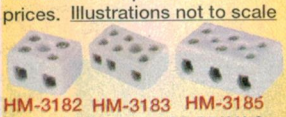

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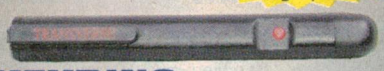

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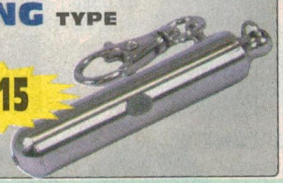

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OVERNIGHT DELIVERY

Today's Networked Vehicle - 2

Here's the second of two articles discussing the evolution of the automobile into a highly networked distributed computer system. In this article the author describes in more detail the most popular automotive multiplexed serial communications protocol, Controller Area Network (CAN).

by Ross Bannatyne,
Transportation Systems Group, Motorola Inc.

CAN IS A multi-master multiplexed serial communications protocol which is used to transfer data between Electronic Control Units (ECUs) in automobiles. It has been estimated that by 2007, there will be 600 million CAN nodes in the world. Today there are approximately 100 million. In this regard, CAN has become the global standard solution for multiplexed serial communications in the automobile. CAN is also widely used in industrial applications as a serial communications bus.

Although CAN was developed and first adopted in Europe, it is quickly gaining wide acceptance in the rest of the world. The main reason for its popularity is that there is lots of hardware and software available to develop CAN systems. In addition, there are now CAN user group conferences and societies which have helped drive the standard to a very high level of popularity.

Apart from the widespread support which is available for CAN, the main reason why it has been embraced in the automotive industry is because it is very *robust*. The specification handles the electrically noisy and extreme conditions which are commonplace in the automobile. CAN networks are also relatively simple to configure. Additional nodes can usually be added relatively easily to a system. Another reason that CAN is attractive is the good error detection capabilities. These will be discussed later in this article.

A typical CAN network in the vehicle will employ both the CAN 2.0A ('basic' CAN) and CAN 2.0B ('full' CAN) protocols, in order to implement a lower speed network at usually 125k bit/sec and a higher speed network of usually 250k bit/sec. This is shown in Fig.1.

Note that although CAN specifies up to 1Mb/s operation, it is rarely used at such high speeds. In a noisy automotive environment, such high speed networks are usually very difficult to implement cost-effectively as a twisted-pair cable medium could not be used. Fibre-optic cable could be used, but is more expensive than twisted pair.

Basic CAN concepts

A CAN-based system implementation deals with the 'Data link' and 'Physical' layers of a communication system. The Data link layer is concerned with message filtering, overload notification, recovery management, message framing, arbitration, acknowledgment, error detection and signalling. All of these functions are normally handled by a digital controller chip, usually integrated, as a 'CAN module', onto a microcontroller. The Physical layer defines how messages are actually transmitted. Usually an analog-based chip will be used to implement the physical layer, which controls bit timing, bit encoding and synchronization.

Information is transmitted serially on the bus. The messages are of a fixed format, but may vary in the length of data which is contained in them.

Each node has an address and new nodes may be added to the system without any changes in the software or hardware of the existing nodes. This flexibility is very important to automotive manufacturers as it allows more systems to be tied together as vehicles become more advanced. The same type of networks and modules can be used in compact and economy vehicles as well as luxury vehicles.

Messages

Information is broadcast on the bus in fixed-format messages. Any node may transmit a message when the bus is not being used.

If two or more nodes start to transmit a message at the same time, a collision will be detected and the highest priority message will win bus access. The lower priority node which loses the arbitration will automatically re-transmit its message when the bus is free. An arbitration field in the message packet is used to indicate the priority of the message.

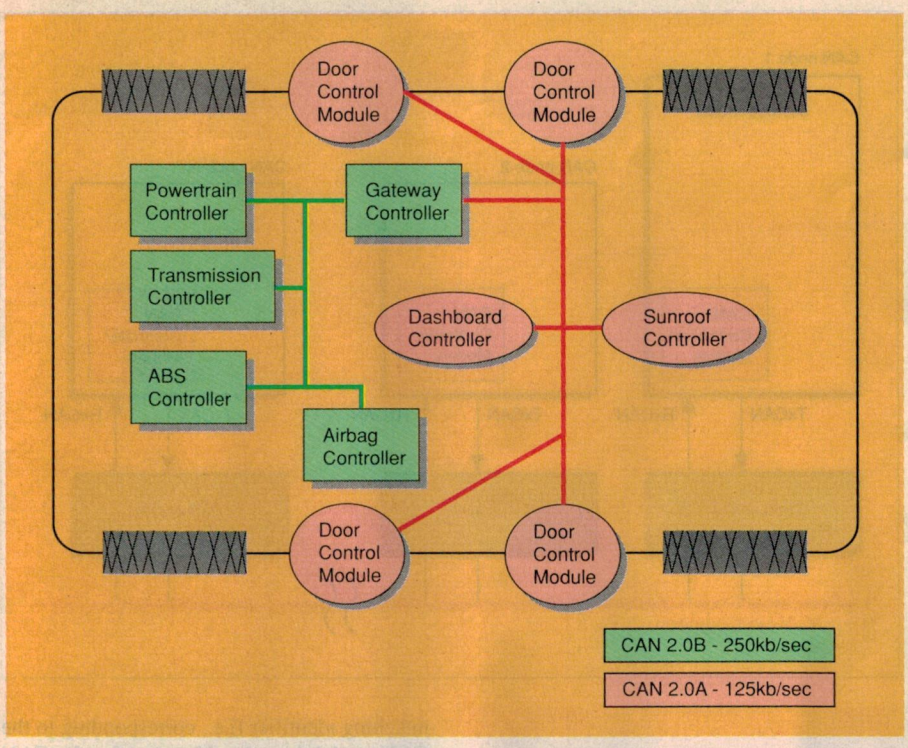


Fig.1: A typical CAN based vehicle network.

Any number of nodes connected to the CAN network can simultaneously receive a message. A filter in the Data link controller is used to determine whether the message will be accepted or disregarded. Each receiving node will check the message and will acknowledge error-free messages.

There are five different message types: Data Frames, used to transmit data; Remote Transmission Request Frames, used to request a frame; Error Frames, used to indicate a bus error; Overload Frames, used to create a delay between frames; and finally an Inter-Frame, which is used to ensure that only data and remote frames can be transmitted under host control.

The CAN extended message format is illustrated in Fig.2 (note that the bit field width is not to scale). The extended message format represents the CAN 2.0B specification, which has 29 ID bits in the arbitration field. CAN 2.0A needs only 11 ID bits, so the additional 18 ID bits may be removed from the arbitration field when the 2.0A version is being implemented.

The smaller identifier for CAN 2.0A means that there is less silicon overhead required for the Data link circuits. It is also more efficient, as less bits in the message are associated with 'overhead' bits.

The CAN bus is idle when in the high position (logic 1), and when a 'Start of Frame' (logic 0) is transmitted the bus is pulled low to indicate to all components connected to the bus that a frame is being transmitted.

The bits represented in Fig.2 are as follows:
SOF: start of frame
SRR: substitute remote request
IDE: identifier extension bit (for 2.0B)
ID fields: a total of 29 bits for extended format
RTR: remote transmit request
R1, R0: reserved
DLC: data length code; indicates number of bytes in data field
DATA: 0 to 8 bytes
CRC: Cyclic redundancy code, for error checking; consists of 15-bit CRC followed by delimiter bit
ACK: acknowledgment bit, followed by delimiter bit
EOF: seven bits to indicate end of frame
INT: three bits to indicate intermission

For an extended frame, this is a total of 64-128 bits, depending on the data field width.

Error detection

Part of the popularity of the CAN protocol is due to its error detection mechanisms. CAN implements five such error detection systems. At the message level there is a cyclic redundancy check (CRC), frame checks and acknowledgment error checks. At the bit level, there is bit monitoring and bit stuffing.

A 15-bit CRC is computed by the transmitter and is based on the message content. All the nodes which receive the message recalculate the CRC and compare this to the transmitted CRC. If the CRC calculations by the sender and receiver do not match, a CRC error is flagged.

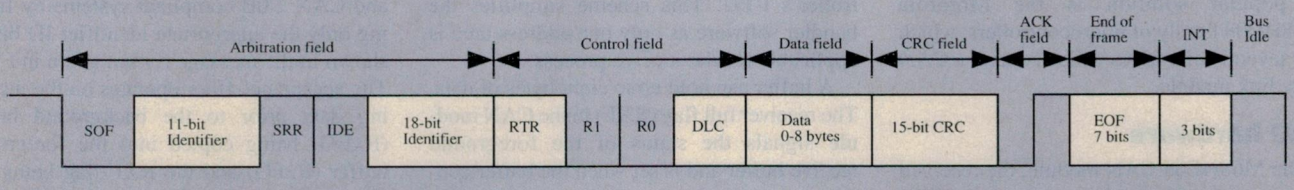
For the frame check, a receiver will check the CRC delimiter bit, ACK bit, end of frame bit and the interframe space. If there is an invalid bit in any of these positions, a format error will be flagged.

The final message level error detection mechanism is the acknowledgment error check. If a transmitter determines that a message has not been acknowledged, then this error type is flagged. These types of errors may occur because of transmission errors, because the ACK field has been corrupted or there are no operational receivers.

At the bit level, bit monitoring is employed by the transmitting node for each bit level. The only time when bit monitoring is not employed is during arbitration or on the ACK slot. Also at the bit level, bit stuffing is used to guarantee enough edges in the bit stream to maintain synchronization. After five identical and consecutive bit levels have been transmitted, the transmitter will automatically inject (or 'stuff') a bit of the opposite polarity into the bit stream. Receivers of the message will automatically delete such bits. Therefore, if a node detects six consecutive bits of the same level, a stuffing error is flagged.

In addition to these error detection mechanisms, if a CAN node receives messages faster than it can process them, the node will signal an overload condition and then send an overload interrupt to the CPU.

Fig.2: The format of a CAN message — in this case, CAN 2.0B.



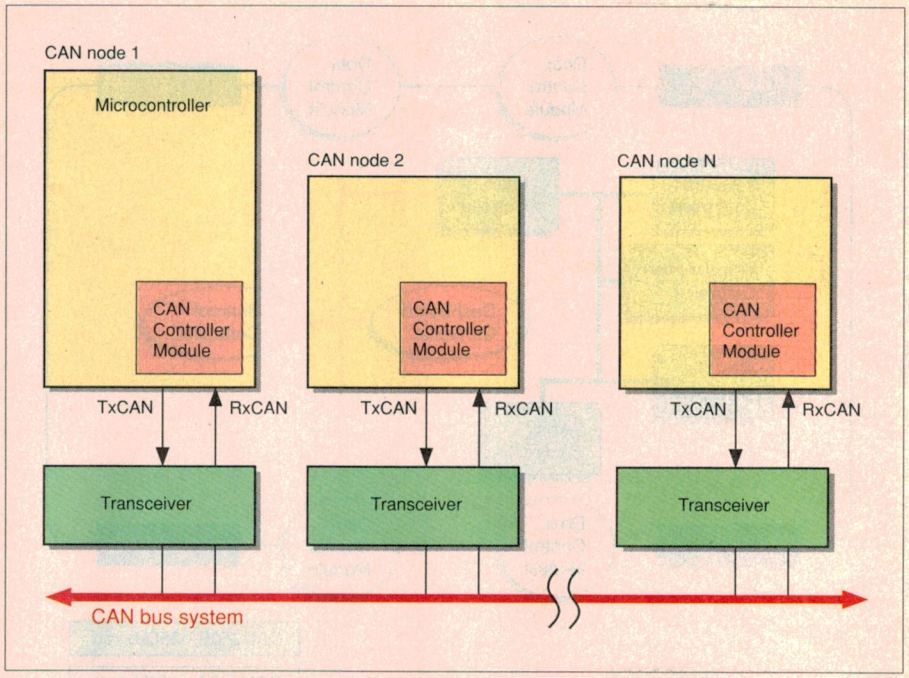


Fig.3: A typical CAN system configuration.

System requirements

To implement a serial communications system, there are usually two distinct products required: the controller and the transceiver chip. The CAN controller would usually be integrated onto a microcontroller as a 'peripheral module'.

A typical CAN system with a microcontroller using integrated CAN is shown in Fig.3. The integrated CAN module uses two external pins, the output TxCAN and the input RxCAN.

Each CAN 'station' is physically connected to the CAN bus lines via a transceiver chip. The transceiver is an analog-based integrated circuit and is capable of driving the large current needed for the CAN bus. The bus medium is usually a twisted pair of wires driven differentially, but fibre-optic cable is becoming more common for higher speed networks.

There is usually intelligence at each node, which gives the node the ability to perform some functions autonomously. If a node malfunctions, the remaining nodes in the network are in most cases unaffected and the system will still have a certain degree of operability.

Fig.3 could be representative of an automotive master-slave body electronics system, with the microcontroller being the central controller, CAN node 2 representing a seat position control circuit (to drive the position motors) and CAN node N representing say a side mirror circuit (to drive position motors). This type of configuration would be used in an automobile which has a 'memory' for different driver preferences and by pushing a certain switch in the dashboard, several different body systems can be reconfigured automatically.

There will be a simple user interface between the microcontroller and the CAN Data link module (which is usually integrated into the same chip as the microcontroller). This interface is usually just a set of control and status registers.

There are many different CAN Data link controllers used in the industry — each semiconductor supplier has its own design. A popular solution is the Motorola M68HC08 family of microcontrollers, which has several derivatives which contain a CAN Data link module.

DLC hardware

In the M68HC08 CAN module, the received messages are stored in a two-stage FIFO memory. The two Rx message buffers are mapped using a 'ping-pong' arrangement in a single memory area, as shown in Fig.4.

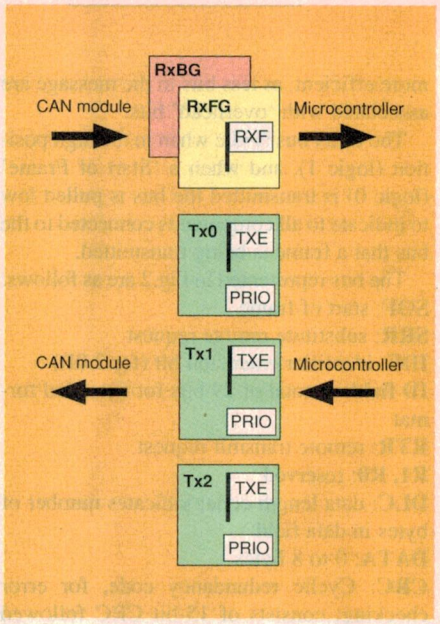


Fig.4: The CAN receive and transmit buffer hardware in an M68HC08 CAN module.

While the background receive buffer (RxBG) is exclusively associated to the CAN module, the foreground receive buffer (RxFG) is addressable by the microcontroller's CPU. This scheme simplifies the handler software as only one address area is applicable for the receive process.

A buffer can hold up to eight bytes of data. The receiver full flag (RXF) in the CAN module signals the status of the foreground receive buffer and is set when the buffer contains a correctly received message with matching identifier (i.e., corresponding to the CAN module's node address). After the CAN module has received a message into the background buffer it copies the contents of RxBG into RxFG, sets the RXF flag and can be configured (or masked) to interrupt the CPU. A new message, which may follow immediately may then be received into RxBG.

Microcontroller handler software is required to read the received message from RxFG and to reset the RXF flag in order to acknowledge the interrupt and to release the foreground buffer. If this is not handled, an overrun condition could occur. An overrun occurs when both the foreground and background receive message buffers are filled with correctly received messages and a further message is being received from the bus. The latter message will be discarded and an error interrupt with overrun indication will occur (if it has been enabled in the appropriate control register).

While in this overrun situation, the CAN module will stay synchronized to the CAN bus and is still able to transmit messages, but will discard all incoming messages.

A programmable identifier acceptance filter has been included on the CAN hardware in order to reduce the CPU interrupt loading. This filter intercepts all messages received by the module and determines if it was intended for that particular node. The filter is programmable to work with both CAN 2.0A and CAN 2.0B compliant systems by filtering only the appropriate identifier ID bits as shown in the message format given in Fig.2. The acceptance filter operates on the incoming data prior to the background buffer (RxBG) being copied into the foreground buffer (RxFG) and the RXF flag being set. When this occurs, it is said that an 'accep-

tance filter hit' occurs.

Fig.4 also indicates the triple transmit buffer scheme implemented on the M68HC08 CAN module.

When two or more nodes are connected to the CAN network, arbitration may be required. Networks may be either peer-to-peer or master-slave. When a master-slave network is implemented, the master controls which nodes can transmit data on the bus and the slave nodes cannot transmit unless instructed to by the master. For a peer-to-peer network, arbitration is required as two or more nodes may attempt to transmit on the bus simultaneously. The arbitration scheme works by assigning each message a priority, thus access collisions are not possible in a CAN network.

Application software is written with two fundamental assumptions:

(1) Any CAN node is able to send out a stream of scheduled messages without releasing the bus between two messages. Such nodes will arbitrate for the bus right after sending the previous message and will only release the bus in the case of lost arbitration; and

(2) The internal message queue within any CAN node is organized such that the highest priority message will be sent out first, if more than one message is ready to be sent.

In order to meet the requirements of these two assumptions, a minimum of three transmit buffers is required.

Although some advanced CAN controllers implement *more* than three buffers (the M68HC12 16-bit microcontroller family, for instance, has a CAN controller which has up to 16 transmit buffers), the M68HC08 CAN module was designed with a low-cost implementation very much in mind. More buffers add more cost.

In addition to the 13-byte data structure of the receive buffers, the transmit buffers have an 8-bit 'local priority' control byte (PRIO, indicated in Fig.4) and a 'transmit buffer empty' flag (TXE) used to identify an available transmit buffer to the CPU. The CAN module will schedule a message for transmission and will signal successful transmission of the buffer contents by setting the TXE flag. An transmit interrupt will be emitted (if not masked) when the TXE is set and can be used to drive the application software to re-load the buffer.

In the case where more than one buffer is scheduled for transmission, the CAN module uses the 'local priority' setting of the three buffers for prioritization. For this purpose, the transmit buffers have an eight-bit local priority field, PRIO). The application software sets the priority when the message is set up.

Fig.5: A CAN-based automotive instrument cluster system, using the Motorola MC68HC12BC32 microcontroller.

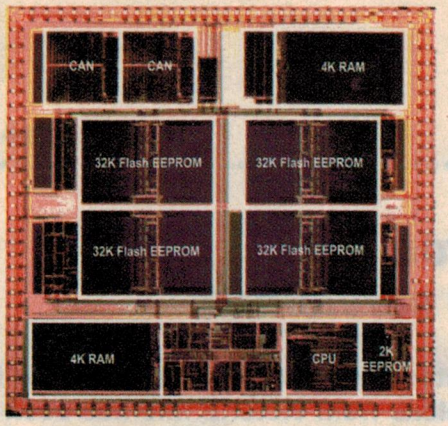


Fig.6: A photo of the die for a M68HC912DG128 microcontroller, which has two CAN Data Link modules for use in CAN gateway controller applications.

Example system

An example of a CAN-based automotive instrument cluster system is shown in Fig.5. The instrument cluster is an ECU which controls the tachometer, speedometer, fuel and temperature gauges and some dashboard warning lamps.

At the heart of the control system is the M68HC12BC32 microcontroller with integrated CAN Data link control module. The ECU uses information from other vehicle systems such as the Powertrain ECU, Braking ECU and Transmission ECU as inputs. These systems are networked to the Instrument cluster ECU by the CAN bus, via the transceiver chip (Physical layer) which is shown is the MC33388. The microcontroller CPU receives the messages from the message buffers in the CAN module and the host software controls how these messages influence the actions of the output drivers. This is a fairly typical CAN-based application in the automobile.

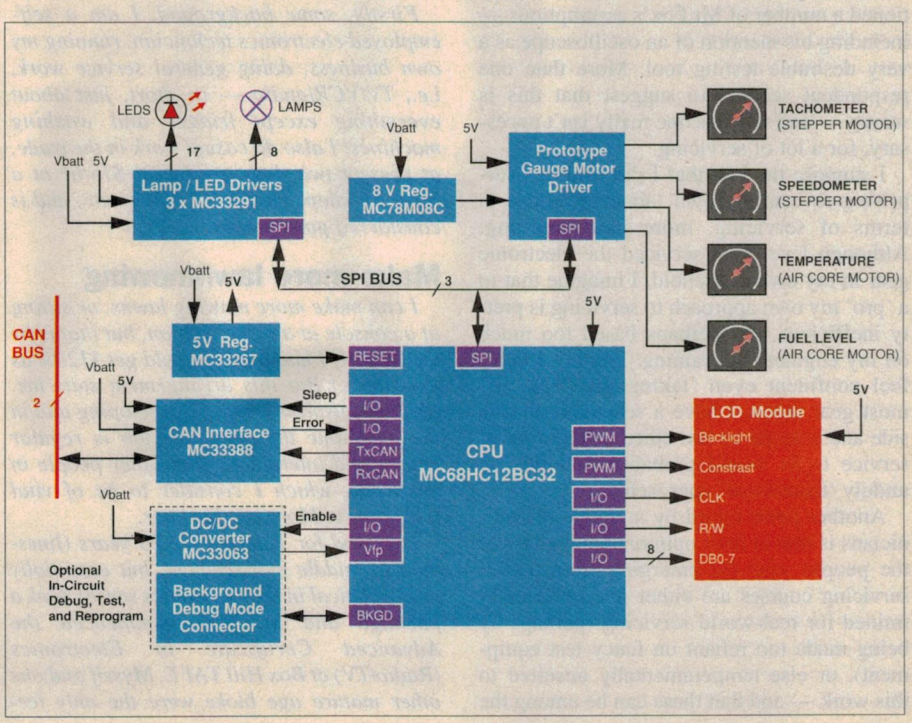
Conclusion

This was the second of two articles which have discussed the evolution of the automobile into a highly networked distributed computer system. In the first article (last month) we discussed the motivation behind the networked vehicle, its characteristics and some future developments in this area. This article has focused on the most popular automotive serial communications protocol, Controller Area Network (CAN) and has described its philosophy, operation and hardware environment.

There are many different serial communications protocols and each has its own communications philosophy and hardware requirements. Standardization has helped reduce costs and encourage further adoption.

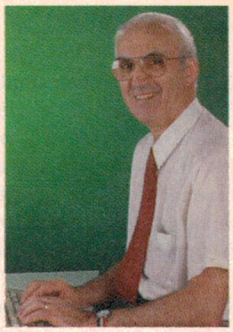
CAN is an attractive solution as its high speed capability (to 1Mb/s) has not yet been fully realised. As the costs for advanced communications mediums such as fibre-optic networks reduces further, this will increase the possibilities and performance of CAN-based systems. Further growth into the industrial market is also expected for CAN.

In closing, Fig.1 illustrated a typical vehicle architecture in which there are two CAN networks, linked by a gateway. It follows that a microcontroller at the heart of the gateway controller would also need to have two CAN Data Link modules. Such an example of a microcontroller is shown in Fig.6, the Motorola M68HC912DG128. ❖



Forum

Conducted by Jim Rowe



What test gear DO you need for electronics servicing?

There's been an interesting response to the letter in May's column from R. Fox, the frustrated young bloke from Victoria who has been trying to break into electronics servicing. Somehow his letter seems to have triggered off questions on how much test equipment really IS needed for effective servicing, and whether TAFE courses in servicing really do prepare students for servicing in the 'real world'...

HOPEFULLY YOU'LL RECALL the letter from Mr Fox, who has done some TAFE courses in servicing, but now seems to be caught in the old 'no experience, therefore no job/no work, therefore no experience' conundrum. As a result he's been trying to gain some experience by tackling servicing jobs from home — but inevitably finds that he lacks the funds to buy test equipment like an oscilloscope. He was writing in the forlorn hope that one of our other readers might have an old scope that they might be willing to pass on.

To be honest, I don't know if anyone has offered him a scope as yet, but judging by the letters and emails *I've* received, his letter certainly seems to have generated a fair bit of interest. But one aspect that has surprised *me*, at least, is the way a number of readers who are experienced in servicing have questioned a number of Mr Fox's assumptions — including his mention of an oscilloscope as a very desirable testing tool. More than one respondent seemed to suggest that this is wrong — and that a scope really isn't necessary, for a lot of servicing.

I suppose the fact that I did find this surprising reveals my own 'amateur' status in terms of servicing, more than anything. Although I've often serviced the electronic gear in my own household, I imagine that to a 'pro' my own approach to servicing is pretty inefficient, and perhaps based too much on my engineering training. Frankly I don't feel confident even 'taking the back off' most gear unless I have a schematic to one side and a scope on the other — but a lot of service techs would probably find this an unduly 'theoretical' approach...

Another point raised by a couple of technicians is that in their opinion, quite a few of the people who are emerging from TAFE servicing courses are either not sufficiently trained for real-world servicing (perhaps by being made too reliant on fancy test equipment), or else temperamentally unsuited to this work — and that these can be among the reasons why they don't have any luck in finding a job.

Anyway, that's the background. So let's look at one of the email responses that arrived almost as soon as the May issue was published, from Mr Andrew Blight of Glen Waverley in Victoria. Mr Blight is also a radio amateur (VK3BFA), but in this case he's writing in his capacity as a service tech, both employed and self-employed. Here's what he had to say:

It was with some interest I read your 'Forum' column this month, in particular the letter from Mr R. Fox. I feel the letter raises many important issues that need to be considered in the context of the electronics trades in this country. I have been following the debate for some time now via your magazine and would like to put in my 'two bob's worth'.

Firstly, some background. I am a self-employed electronics technician, running my own business, doing general service work, i.e., TV/VCR/audio — in short, just about everything except fridges and washing machines! I also do casual work in the trade, at present two days a week at $15/hr at a local TV shop. This is the going rate, and is considered good money.

Make more lawnmowing

I can make more mowing lawns, or sitting at a console at a petrol station, but that is by the way. (If I had a BA, I could get $12/hr as a waiter...) But this arrangement suits me. My own business is slowly developing and in the meantime the part time job is regular money and interaction with other people in the trade, which I consider to be of vital importance. More on this later.

I worked for Telecom for 20 years (linesman to middle management, but essentially non-technical in the electronics sense), took a package and in 1993 commenced the Advanced Certificate in Electronics (Radio/TV) at Box Hill TAFE. Myself and one other mature age bloke were the only fee-paying students out of a class of 18; the rest were on some sort of AUSTUDY grant or other. Strangely enough, five years later we are the only ones still working in the trade.

Prior to that I had electronics as a hobby; got my amateur license in 1971 as a kid, read EA since then, built projects and restored junk, pretty much like most of your non professional readers.

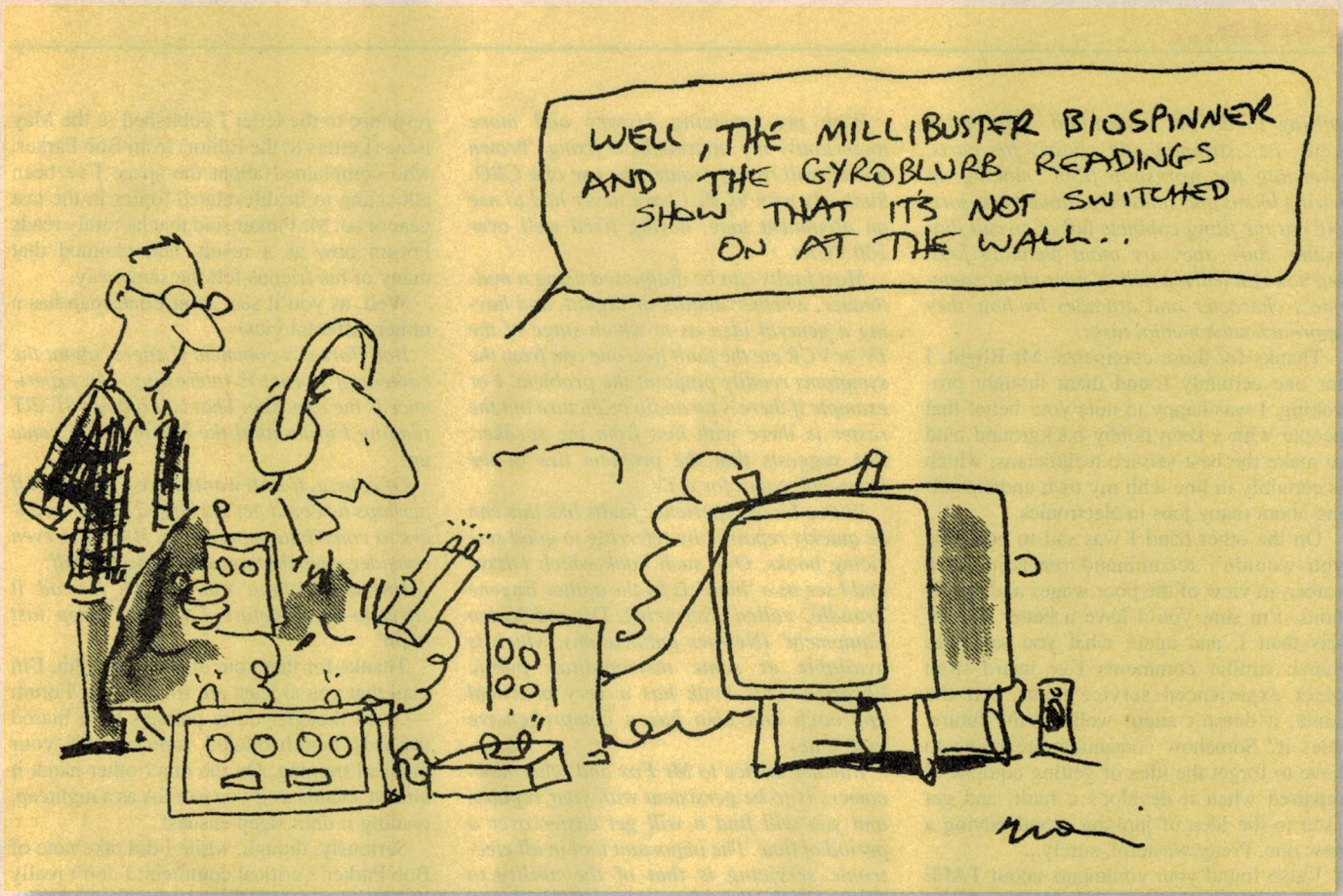
When I left Telecom I decided to make a living out of my hobby, so went back to school to fill in the blatant gaps in my knowledge. And what an education it was — two years of solid theory with a bit of practical work. I wound up working part time at a local TV shop where I had done a work experience placement, and that's when my real education began.

For two years I learnt my trade, learnt how to fix things quickly, without circuits, and without anything more sophisticated than a multimeter and a flaky 15MHz CRO with intermittent triggering, only one channel working and a low emission gassy tube (i.e., a typical workshop CRO). I did build the ESR meter (a Godsend) and recently the LOPT tester.

At the end of 1999 I have a small business that provides a reasonable living for myself and eventually my wife when she retires. It's been a hard slog, but I've no regrets because I am doing what I like doing.

I remember as a kid dragging old valve radio chassis home on the back of my push-bike, getting a real thrill when a piece of long dead junk could be massaged to life, or provided bits for a project. I still get that "YESS!" feeling when I crack a hard fault now; it's wonderful — but it doesn't pay the bills. Realistically, I make a living from the things I can fix quickly and get out the door; the special projects are alas an occasional indulgence. (As is amateur radio/vintage radio, purely due to time constraints.)

Someone once told me that electronics is unique in that it is one profession where you have to keep learning and studying all your



life if you are to have any hope of competence. I believe this is true. Most working techs have a real interest in electronics, we buy and read EA (and everything else as well), we talk about jobs when we meet, we go to lectures on related subjects, we have sheds full of 'one day when I get the time' projects. In short, we are still enthusiasts as we were as kids 30-plus years ago.

Other techs can pick this up. I was desperate for work experience when I started out, as I was aware how little I knew. One chap gave me a go, and became a great mate. Years later, I asked "Why did you take me on, I was as green as grass?" He replied "Because you were willing to have a go and to learn, and had some background in electronics. Your Certificate only meant you could pass the exams, nothing more." The place I work at now part time had the same reasons for employing me.

Wouldn't recommend it

Am I reasonably happy being a tech? Yes. Would I recommend it to a young person starting out? Definitely not.

You do this job because you like it. You will never be rich and can make a better living doing almost anything else. I am lucky; the house is paid for, my wife has a good job (she was supporting me for a few years) and after a long battle I am doing what I want to. I am a generalist who can do most things and thus have a pretty good chance of making a living into my old age.

If I was a young person starting out, or with a young family to support, I could not recommend the servicing game. It's got lousy wages and terrible conditions.

Doing a two-year TAFE course in no way equips you to be a competent technician. I would view it as half of a four year apprenticeship. But where do you get the extra two years? This is the dilemma.

To get a paid job as a tech, any employer will expect you to hit the floor and start turning out jobs for a profit (and to pay your wages). Given also that most learner techs can (and do) make the occasional horrendously expensive mistake, then it is an uphill battle. It can be done; there are a few people out there willing to take a punt on you if they think you are up to it, but alas, they are too few for the available graduates.

The TAFE colleges are now run on economic rationalist lines, i.e., they are producing 'product'. Their next year's funding depends on how many go through the system. Towards the end of my course, I was bogged down in Microprocessors and was agonising that I would not pass the course. A teacher friend of mine smiled at me and said "Haven't you realised yet, everyone will pass." She was right, everyone did — even the blatantly incompetent and the temperamentally unsuited. It would have been a real kindness to some of them if someone at the six-month mark had said "You are not really suited to be a tech, we think you should try some other avenue of tertiary study..."

The teaching environment is not a reflection of the real world, either. I can well remember the Alladin's Cave of the Prac Room. A 100MHz CRO, FM signal generators, HP Noise and Distortion Analysers, professional Sony monitors, Wharfedale speakers on every bench! Gosh — it ain't like that outside. If you are really lucky, the roof doesn't leak and there is only a mild cold wind past your feet in the winter. If it's a top class establishment, there will be an isolation transformer.

Test equipment, forget it. Most service establishments are rudimentary and very close to Third World levels. As a hobbyist one is used to this, but without this background how are the new graduates in any way prepared for the real world?

We have work experience students where I work part time, and without exception it's the one with the hobby background (and enthusiasm) who gets offered jobs and has some sort of a chance to make a go of it.

The problem is not so much lack of work experience for graduates, rather it is the people who graduate — they are unemployable. Most of them can't even solder competently. Would you let them loose on a customer's TV or VCR? I think not. They are not

willing to do the traditional 'apprentice jobs', i.e., stripping old chassis for parts, sweeping the workshop floor, making up wiring looms and soldering connectors, sorting out the filing cabinets full of circuit diagrams. Sure, they are mind numbing jobs, but you can learn a hell of a lot about someone's character and attitudes by how they approach such menial tasks.

Thanks for those comments, Mr Blight. I for one certainly found them thought provoking. I was happy to note your belief that people with a keen hobby background tend to make the best service technicians, which is certainly in line with my own understanding about many jobs in electronics.

On the other hand I was sad to note that you wouldn't recommend servicing as a career, in view of the poor wages and conditions. I'm sure you'd have a better idea of this than I, and again what you say does match similar comments I've heard from other experienced service techs. All the same, it doesn't augur well for the future, does it? Somehow consumers are going to have to forget the idea of getting equipment repaired when it develops a fault, and get used to the idea of junking it and buying a new one. Pretty wasteful, surely...

I also found your comments about TAFE courses pretty sobering, too. If the colleges are simply cranking out 'products' with only a token degree of training and aptitude for the real world, surely they're simply playing into the hands of the economic rationalists who see servicing as not worth the money.

While I'm not doubting your report of the situation at the TAFE college you attended, I guess we have to hope that this isn't the situation at all of them. Hopefully at least *some* of them are focussing on meeting real-world needs for technicians, and more emphasis on turning out people with a known level of skill and understanding. Perhaps one of the people from TAFE, or from the industry associations like TETIA and TESA might like to offer us some reassurance.

Practical advice

Moving on, though, another response to Mr Fox's letter came from Mr Paul Hetrelezis, of Noble Park in Victoria. Mr Hetrelezis also seems to be an experienced service tech, and as you'll see he's also offering some down to earth advice to newcomers like Mr Fox:

Like Mr R. Fox I started off servicing with limited resources and I still do not use any sophisticated equipment such as a CRO, alignment tapes and tools. Firstly I was self-taught with TVs, then later VCRs and later still CD players. After reading the Forum article in the May issue, I believe Mr Fox's approach of trying to repair 'brown goods' is overall wrong, particularly so for his financial situation.

With my servicing history and more importantly my approach to fixing 'brown goods' will rarely require the use of a CRO. Similarly with VCRs I have never had to use an alignment tape, having fixed well over 100 VCRs.

Most faults can be diagnosed using a multimeter, whether analog or digital, and having a general idea as to which stage of the TV or VCR etc the fault lies, one can from the symptoms readily pinpoint the problem. For example if there's no audio or picture but the raster is there with hiss from the speaker, this suggests that the problem lies in the front-end stages for a TV.

With a bit of experience faults like this can be quickly repaired by referring to good servicing books. One such book which I have and I see as a 'bible' is by the author Eugene Trundle, called 'Servicing TV and Video Equipment' (Newnes publication), which is available at some metropolitan public libraries. This book has a very practical approach and also has a comprehensive fault index.

Further advice to Mr Fox and other newcomers is to be persistent with your repairs, and you will find it will get easier over a period of time. The important tool in all electronic servicing is that of the ability to methodically diagnose problems, which will eventuallly come with experience.

Thank you indeed for your comments and advice, Mr Hetrelezis. They seem very practical and constructive, and hopefully Mr Fox and other newcomers might be able to benefit from your experience. It sounds like you're suggesting that instead of waiting until he can acquire more test gear, his best plan might be to try doing unpaid volunteer work at a service shop for a while, to get as much experience under his belt as possible. And that sounds pretty good advice to me, along with your comment that well-tuned diagnostic skills are probably the most important tool of all, for real-world electronics servicing.

All the same, my hat's off to anyone like yourself who manages to service a lot of gear with little more than a multimeter and your finely-tuned diagnostic skills. I certainly admire your ability to do this — I'm sure that I for one couldn't survive without at least a decent CRO!

Different view

To end off this month's column on a different note, I'd like to offer a small email message I received from Dr John Loadsman, a specialist anaesthetist who's also a keen electronics and MIDI enthusiast. You may recall that Graham Cattley featured his interesting web site in May's Webwatch column.

On this occasion, though, John Loadsman is offering a comment about Forum — and in response to the letter I published in the May issue (Letters to the Editor) from Bob Parker, who complained about the space I've been allocating to health-related topics in the last year or so. Mr Parker said that he rarely reads Forum now as a result, and claimed that many of his friends felt the same way.

Well, as you'll see, John Loadsman has a rather different view:

Bob Parker's comment (Letters) about the content of Forum is interesting. My experience is the opposite. That is, I did not START reading Forum until the health issues came up!

Of course, if Bob wants to read other stuff perhaps he could get his lapsed Forum readers to contribute more often. He might even consider contributing something himself.

Interesting mag this month. I read it cover-to-cover before I went to sleep last night.

Thanks for that vote of support, John. I'm glad that you at least are still reading Forum — even though you're perhaps a bit biased towards health-related topics, with your medical training. On the other other hand, it almost sounds as if you use EA as a nightcap, reading it until sleep ensues!

Seriously, though, while I did take note of Bob Parker's critical comment, I don't really feel the need to make apologies for the health related material I've been trying to present in Forum. While a lot of technicians like Bob do seem determined to dismiss any concern about cellphones and electronic quackery as lightweight and boring, frankly I don't agree.

To me, these topics are quite important, and just as much to those of us with direct knowledge and experience of electronics as to the broader population. Perhaps more so, in fact, because often we're in more of a position to be able to sift facts from bulldust and emotion, and offer sensible advice to our families and friends.

By the way, I'm not criticising Bob Parker here; he's certainly entitled to his opinion, especially about what he wants to read. That's why I published his letter, in fact.

I should perhaps also note that Bob himself has made some very valued contributions to *EA*, over the years. His excellent Capacitor ESR Meter and LOPT Tester designs have been very popular with readers all around the world, for example, and before them his ACS Decoder for FM receivers was also a great performer.

So while it's nice to know that people like John Loadsman don't mind a fair bit in Forum about health related matters, I realise that whatever I do, I'm never going to please everyone. And if Bob Parker wants to concentrate on his justly famous DIY project designs, instead of reading Forum, that's certainly OK by me. Especially if he sends at least some of them to us, for publication! ❖

Serviceman

The waterbed controller that *couldn't* have been fixed without help via the Net!

One of my stories this month concerns a colleague who tried to repair the electronic temperature controller a waterbed — and succeeded, thanks to help obtained via the Internet. The other story is from my own bench, about wrestling with a VCR which had two faults, even though the customer didn't bother to tell me about one of them...

I WISH CUSTOMERS would tell me the *whole* story when they bring a product in for service. It can make a lot of difference as to whether the job is worth doing or not.

These reflections arose from a job that came into my workshop recently. It was a Panasonic VCR, model J1, and the complaint was that the owner couldn't record anything. What he meant, but didn't say (among other things), was that he didn't know how to set up the VCR tuner.

When I first set it up on the bench, I plugged in and switched on; but nothing happened. It seemed that there was no power getting to the machine. So before I could do anything about checking the tuning, I had to solve this unexpected problem.

I opened it up and checked the fuse, then the connections between the power supply and the rest of the set. I found the plug and socket were connected, but not pushed together tightly. After correcting this and switching on again, everything came good and I proceeded to tune the local channels.

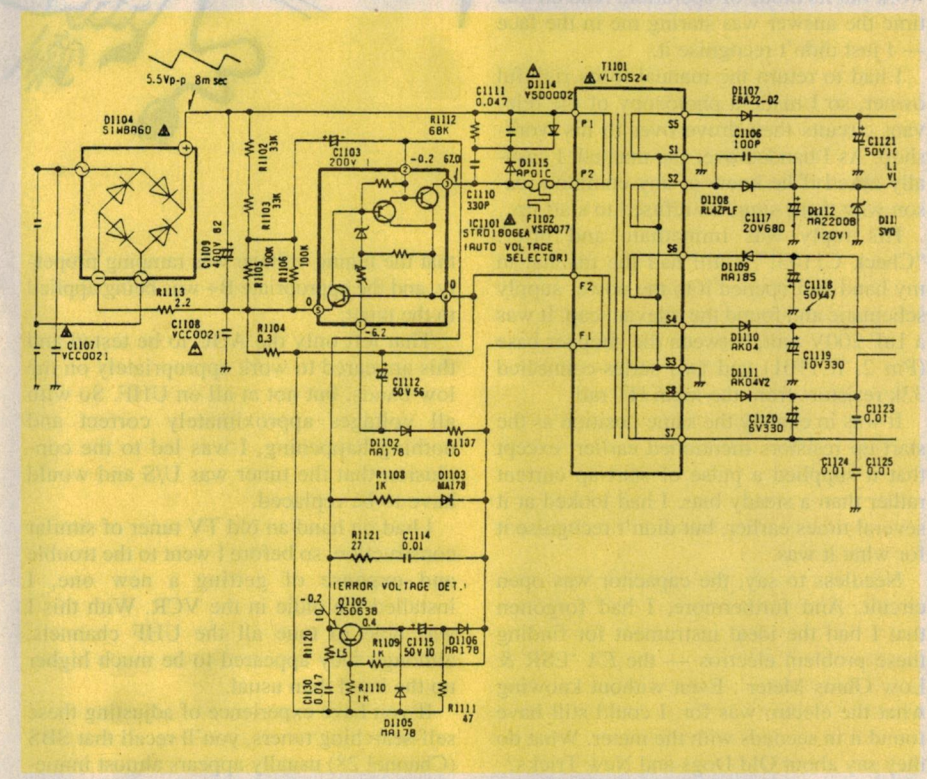
There was no difficulty tuning the band I and III channels, but nothing I could do would produce any UHF signals. Well, that's not *quite* correct. Scanning the band produced a number of flickers in the level of snow on the screen and brief swishes in the audio hash issuing from the speaker, in each of the positions where I would have expected a channel. So there was *something* there, but nothing that was resolvable as a TV signal.

Since I was going to have to investigate the tuning circuitry and as I don't have a manual for this model, I put the job aside until I could get the required documentation.

Next day, with a borrowed manual on hand, I began to probe the tuning problem. But this revealed a return of the previous problem. The machine would not switch on, behaving exactly as it had done the day before.

This time reseating the plug and socket made no difference and the power supply was now completely dead.

I opened the supply and began checking the various transistors, diodes and capacitors as far as they were accessible. The J1 power supply is a very compact unit and many of the components are not easy to get at.



The power supply for a Panasonic VCR, model J1. The Serviceman had to tackle a 'no go' fault in this area first, before looking into the problem that had prompted the customer to drop the VCR in for repairs...

Serviceman

This supply is basically a self-oscillating switchmode type, having many similarities with with early TV supplies. One significant difference to the old supplies is that the chopper transistor is combined with a driver transistor in a five-pin flat pack and this can make it confusing to diagnose.

Fortunately, in this case, Panasonic had chosen to show the flat-pack's internal arrangement in the schematic diagram — so it was relatively easy to determine that the chopper transistor was neither open nor shorted, and the other pins gave readings that looked logical even if I didn't know their absolute values.

Another useful clue was that the main filter capacitor remained charged after the power was switched off. In this type of supply, that suggests that the chopper is not being switched on, usually due to an open circuit resistor feeding start-up bias from the main HT rail.

However, in this circuit there seemed to be no such resistor and I couldn't work out how the circuit ever got started. I spent half an hour poring over the diagram trying to work out its mode of operation. And all this time the answer was staring me in the face — I just didn't recognise it.

I had to return the manual to its rightful owner, so I made a photocopy of the relevant circuits then drove over to his workshop. As I handed over the manual, I casually asked if he knew of any common reason why these supplies refused to start up.

His reply was immediate and brief: "Check C1103!" I still had the manual in my hand so I opened it to the power supply schematic and found the relevant cap. It was a 1uF 200V unit, between the chopper base (Pin 2, IC1101) and two series-connected 33k resistors from the main HT rail.

It was in exactly the same position as the start-up resistors mentioned earlier, except that it supplied a pulse of start-up current rather than a steady bias. I had looked at it several times earlier, but didn't recognise it for what it was.

Needless to say, the capacitor was open circuit. And furthermore, I had forgotten that I had the ideal instrument for finding these problem electros — the *EA* 'ESR & Low Ohms Meter'. Even without knowing what the electro was for, I could still have found it in seconds with the meter. What do they say about Old Dogs and New Tricks?

Anyway, replacing the capacitor restored the power supply to full working order and I was able to get on with the fault that had first brought this machine to my attention.

Tuner dead on UHF

I briefly repeated the tests that I had done when the machine first came in, and confirmed that there was no useful activity in the UHF part of the tuner. A voltmeter showed that the tuning voltage was ramping properly, and the appropriate B+ was being applied to the tuner.

That left only the AGC to be tested and this appeared to work appropriately on the low bands, but not at all on UHF. So with all voltages approximately correct and nothing happening, I was led to the conclusion that the tuner was U/S and would have to be replaced.

I had on hand an old TV tuner of similar construction, so before I went to the trouble and expense of getting a new one, I installed the oldie in the VCR. With this I was able to tune all the UHF channels, although they appeared to be much higher up the band than usual.

If you have experience of adjusting these self-searching tuners, you'll recall that SBS (Channel 28) usually appears almost immediately the system starts to search after switching from band III to UHF. This is logical, since Ch28 is nominally the lowest channel in band IV.

In this exercise, Ch 28 was nearly five minutes of searching above the bottom of band IV. I have never seen a tuner that was so slow to scan the UHF bands. It worked at normal speed on the two VHF bands, but slowed to a dead crawl when it came to UHF.

This made me wonder if the original tuner might have been blameless after all. It was possible that we (both the owner and I) had not waited long enough for the search mechanism to reach the first of the UHF channels. So I removed the TV tuner and replaced the VCR's original unit.

Once again, the VHF channels were tuned quickly and easily. But there appeared to be no activity at all on the UHF band. Nevertheless, I kept my finger on the '+' button and after a considerable period — close to five minutes — the first signs of an SBS signal appeared.

It took an interminable time for the signal to stabilise, but eventually it showed a picture as good as any I've seen. The other UHF channels followed equally slowly; but at last I was able to call the owner to tell him he could collect his VCR.

As we conducted the usual post mortem, I learned that the owner had no trouble tuning the VHF channels, only SBS and the UHF commercials. As I had now found, there was nothing wrong with the machine that a little patience would not overcome.

Then I began to explain the trouble I had had with the power supply when he interrupted with "Oh! That's always happened with that machine. It's always been hard to start".

So I told him that if he had given me full details of his (UHF only) tuning problems and the matter of difficult starting, I might have saved considerable time by going straight to the power supply before anything else.

As it happened, it was a second fault just waiting to trap me and I can do without that sort of provocation.

Waterbed thermostat

Now we come to a story about a product we have never seen in these pages before — a waterbed! Well, not exactly the waterbed itself, but the temperature controller for the waterbed heater.

The story comes from Gert Kristensen, of Burnie in Tasmania.

Gert doesn't tell us anything of his background, but he is obviously a keen and patient technician. The device he discusses here is usually a 'throw-away' component, but they *can* be repaired, given time and a source of data about the internals. And it was this latter point that made it all possible, as you will see when you read on...

When our waterbed temperature controller failed, I decided to have a look inside the control box; you know, just in case. The housing split apart easily and revealed a small printed circuit board.

The board carried a PCB potentiometer (for setting the temperature), a small number of resistors and capacitors, one small 8-pin integrated circuit and a triac in a TO-220 case, mounted on a heatsink covering the back of the PCB. To replace any component would require a complete disassembly.

I surmised that the IC was a special purpose unit designed to do simple ON/OFF temperature control with the triac. Whatever the problem was, I decided to go carefully and thus there was no way the unit would be fixed in a day. And with winter coming on, I didn't relish a cold bed; so the circuit was removed completely and the heating pad connected directly to the 240V mains and controlled manually.

I assumed that either the IC or the triac was faulty, so I set out to look for those two components before getting out the soldering iron. The triac was a BT136-500D and the IC was a TDA1024, both carrying the Philips brand.

Neither item was in my reference library so the Internet was used to search for data. I found the BT136-x series of triacs easily enough. The TDA1024 was another matter and many days went by before the data sheet was obtained.

The nearest reference that I could find on the Internet was a TDA1023, a 16-pin package to do much the same thing as the 1024 seemed to be doing. After several hours I felt I had done enough on my own so I e-mailed Philips International with a request for information. I also posted a message on a few of the newsgroups like 'sci.electronics.repair', then I waited.

During the wait period I traced out the circuit board and pin connections and tried to identify components as best I could. When in doubt, components would be unsoldered and measured.

One particular resistor, from 240V active directly to the IC, had cooked slightly, just enough to prevent reading the value. Measuring with a multimeter showed approx 1.2 megohms, an unlikely value, since this would mean the IC would have to run on just microamps! The resistor looked like a 0.5W type and because it was cooked, I feared for the IC.

That the IC might be hard to get was confirmed several days later, when a Mr Tinco Brouwer from one of the universities in Holland responded to my Internet newsgroup posting with a short message that the IC was obsolete, designed for domestic temperature applications, and so old that his current data books did not have any more details.

A plea to Tinco for the pinouts was followed some days later with a positive reply: he had found the pin out details in an older book and so confirmed my guessing at the mode of operation.

To test the IC using a safer and more comfortable AC voltage level, I had an old 30V transformer handy and recalculated a few resistors, then added visual indication by replacing the heaterpad with a 3V @ 300mA globe plus suitable series resistor.

Then things came to a stop for some days during which period some good news arrived.

Tinco came back with a message advising me that on a hunch he had looked on the web at the local electronics outlet, a bit like 'Dick Smith's' in Holland, and yes, they had TDA1023 and TDA1024 chips in stock.

I contacted the company via e-mail and they were quite bemused to get an enquiry all the way from Australia. They advised that the TDA1024 was temporarily out of stock, but a shipment was expected in a few days. I was advised of the cost and also that I was their most remote customer so far.

The second good thing happened when I contacted Philips International again, asking if I could have the e-mail address of the local Philips, sort of a last try.

This time I got a very quick answer from Sydney. Yes, the TDA1024 was a very old product and since data was only generally available on the net for products from 1995 onwards, the TDA1024 would not be found here. Could I give them my mail address and a photocopy would be arranged for me.

The reason for my first message having failed was put to the fact that Philips had done a major re-build of their internet server in Sydney and files had simply been lost. Unfortunately, Philips Sydney was unable to help with the supply of the elusive chip.

When the data arrived I found that the IC has an average design supply voltage around 7V @ 10mA. Applying a suitable 10V DC allowed me to check the simple bridge circuit which generates the temperature error signal.

When the DC was applied, I discovered some odd behaviour with the wiper on the potentiometer which spelt real trouble. The pot, of course, was like nothing I had ever seen before.

Very carefully, I removed the pot then opened the body. I found the wiper had broken loose, so even more carefully I secured this with two tiny screws from an old discarded LCD wristwatch. (I have features in common with the bowerbird).

With the wiper action restored, the AC test could commence. Using the 30V AC supply showed on my oscilloscope that the IC output provided a 400-microsecond triac gate pulse which could be varied by selecting the value of the phasing resistor. Everything seemed to work properly again, and there was no problem with the triac either.

I was intrigued by the mains power supply resistor I had found dead. It looked like a 0.5W unit and the data sheet talked in terms of several watts or more. This was confirmed by very rough estimate using 240V @ 10mA = 2.4W. What was going on? A couple of watts in a 0.5W body spelled 'stinking hot' to me.

Then the penny dropped. The designer had figured that he could run the circuit on a very, very meagre current diet. I have calculated approx 1/10th of that specified (meaning a 0.25W supply resistor).

Instead of supplying the circuit with 10mA, I am supplying it with 1.6mA so the mains supply resistor is now two 150k resistors in parallel, probably about 1W each. They were taken from an old valve TV set and I could just fit them nicely in place.

I have had the satisfaction that comes with finally getting a tricky problem ironed out, and I could do this because I had the luxury of time. It is now two or three months since the repair and the controller is working fine.

So how about that? As you can see, fixing that controller would have been impossible without suitable data, and the data would have been inaccessible without the magic of the Internet, newsgroups and 'World Wide Web'.

This is the second story in recent months that details searching the net/web for information about older products. Somehow, I don't think it will be the last.

Thanks for that story, Gert. I hope that you are still enjoying the results of your efforts, especially now since this will appear just about the coldest time of year where you are. Good luck!

And that's all for now. I've got a good range of contributions on file for coming months, but there is always room for more. (If not, I'll just buy a bigger hard-drive!) ❖

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12V DC 150mA, flash rate 120/per second. 70mm (diameter) x 46mm (height).

White *L 6008*
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ProMeasure Ultrasonic Tape Measure

ProMeasure is a sophisticated tool that speeds up the time taken to make distance, area and volume estimations.

- Measures distances up to 15 metres
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Q 1413

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VELCRO SELECTION

VELCRO, that fantastic re-useable, stick-it material is back! With a superb ripping sound guaranteed to annoy, it is great for holding items onto surfaces so they won't slip (and a fantastic way to do up your sneakers!)

Velcro Heavy Duty

6 pieces black, 22mm x 50mm.

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One wrap strap, 19mm x 200mm. Pack of 8.

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Quality butane powered WSTA-6 soldering iron with 1mm iron-plated tip, piezo ignition, adjustable power control (approx 15-60W), 30 second heat up time and up to 60 minutes operation per recharge. Includes hot blower tip and protective cap. Made in Japan.

T 1425

$99.95 Weller

NEW

TEST EQUIPMENT

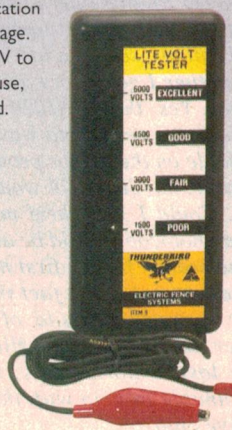
Electric Fence Lite Volt Tester

This handy pocket-sized electric fence tester will give you a clear indication of the fence line voltage. Measures from 1500V to 6000 Volts. Easy to use, no batteries required.

Q 1230

$35

NEW



Electric Fence Digital Voltmeter

This quality digital unit will give you a precise voltage reading of the fence line voltage. The unit measures up to 9,900 (9.9kV) Volts.

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*AVAILABLE Power House & direct link ONLY

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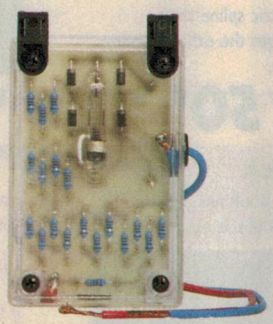
NEW

SILICON CHIP Jun '99



Electric Fence Voltage Tester

Test range from 1.8kV up to 10kV. Includes neon, case, front panel label, and all components.

K 3011

$17.50

NEW

SILICON CHIP Jun '99

Electric Fence Controller

Higher output than previous design - up to 5km multi-wire fence length. Design uses DC-DC inverter to supply 390V DC

- Power supply: 12V DC
- EMI suppressed output
- Much cheaper than commercial units
- Includes high-quality sealed, weather-proof case worth $29

SILICON CHIP Apr '99

K 3009

$79.50

15W "Brick" Stereo Amplifier

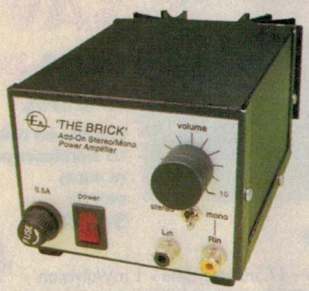
This great compact unit delivers 15W per channel in stereo, allowing you to add extra channels to your home theatre setup, eg rear or centre speakers. It can be easily hidden due to its size, and accepts line output from any source. Use this with your Surround Sound Decoder kit (K 5409) for a low-cost home theatre setup! It's also great as a bench amplifier. Includes deluxe pre-punched black case, front panel label, and all components.

K 5609

$99

NEW

EA Jun '99



Surround Sound Decoder with Delay

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EA May '99

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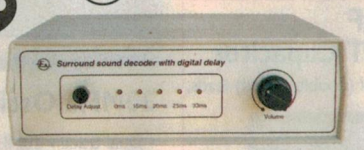

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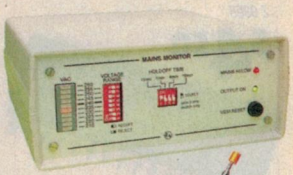

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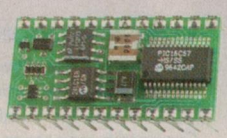

BASIC Stamp 2 Carrier board $49
K 1403

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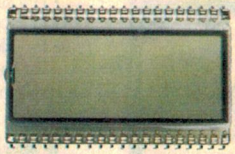

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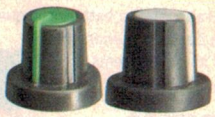

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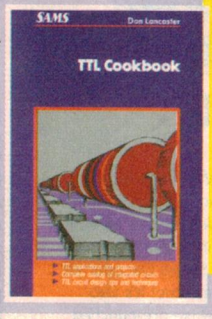

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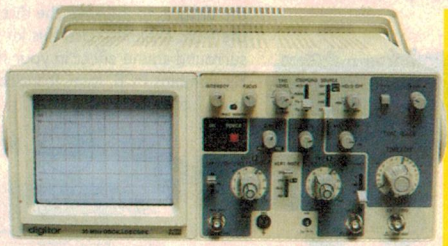

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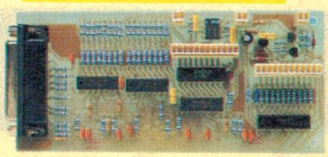

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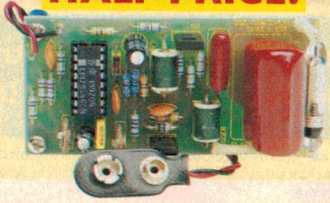

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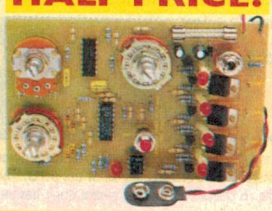

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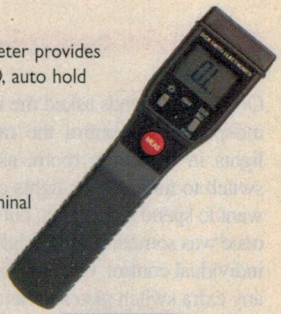

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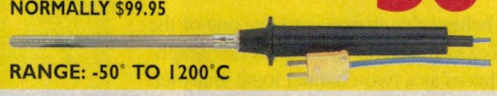

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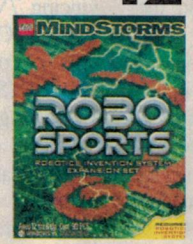

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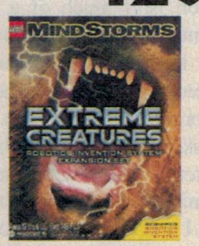

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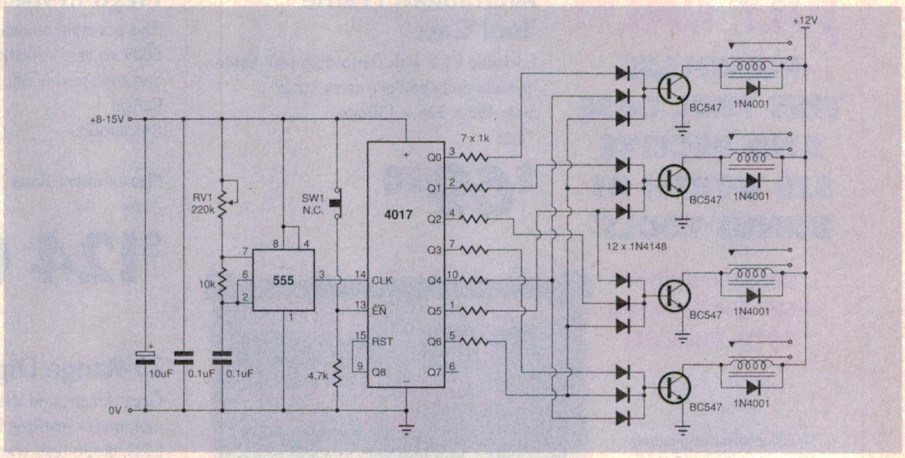
Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Downlight controller



One of my friends asked me if it was possible to independently control the rack of four downlights in his living room, as he only had one switch to turn all four lights on or off. He didn't want to spend much on it, but all four lights on at once was sometimes too bright and so he wanted individual control. Oh, and he didn't want to add any extra switch plates to his wall either!

With a bit of thought, I came up with this reasonably simple circuit. A 555 oscillator clocks a 4017 decade counter, which cycles through the various combinations of lights at around 1Hz. Well, it does if SW1 is depressed, as its enable pin (pin 13) is then pulled low via the 4.7k resistor, enabling the counter. When the desired combination of lights is reached, you release SW1 which pulls pin 13 high, and the counter freezes.

The counter's output activates the appropriate transistor(s) via the diode matrix and the relays pull in, supplying power to the downlights. The cycle speed is set by VR1, and while designed specifically for four downlights, it could be easily adapted to control more with additional slave units, or be used to switch other devices.

Gurbinder Dhillon
Sunshine, Vic **$35**

Logic analyser uses TI graphing calculator

The idea behind this design is to use one of the popular Texas Instruments TI-8x series graphing calculators as a two-channel logic analyser. These calculators have a communications port that allows them to talk to other calculators, computers and various other pieces of hardware. With a bit of assembly language programming (the calculators use a 6MHz Z80 CPU, so it's not hard), you can monitor the port's two I/O lines and display the results on the calculator's screen. Incorporating a trigger function isn't much of a challenge, and the maximum sample rate is about 200kS/s.

An interface circuit should be connected between the calculator and the circuit under test, for a couple of reasons. Firstly to minimise the risk of damage to both the calculator and the circuit under test, and secondly, so you can test circuits with supply voltages other than 5V.

Fig.1 and Fig.2 show two types of interfaces, with Fig.1 being a simple diode circuit that works with supply voltages of 5V and upwards. The reason for the zener diodes is to prevent the I/O lines being pulled below 0V and to protect against faulty 1N4004 diodes (I once got one which would have made a convincing 7V zener). You could also use level shifting ICs (lower voltages) or opto-isolaters (better protection). The circuit in Fig.2 uses MOSFETS and works down to 3V.

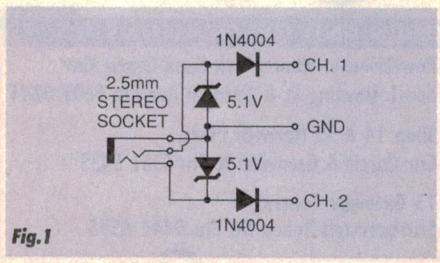


Fig.1

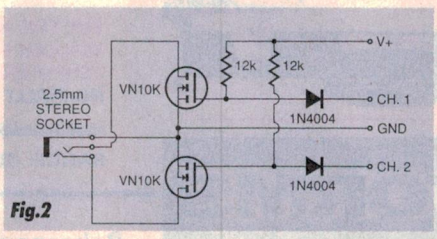
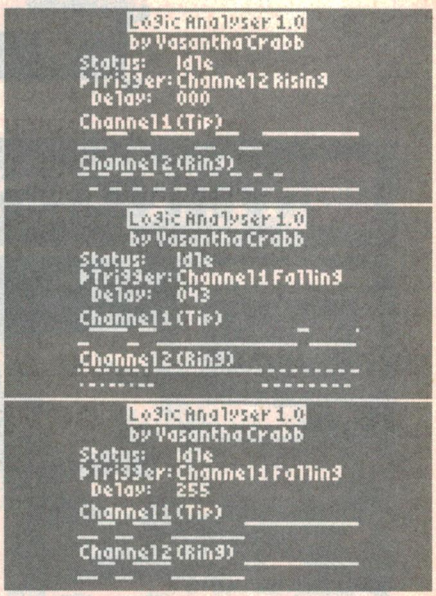


Fig.2

The Logic Analyser software lets you simultaneously capture digital waveforms on two channels and graph them side-by-side. It supports five trigger modes and a wide range of sample rates. While the source code was originally written for the TI-82, it could easily be ported to the TI-85, TI-83 and TI-86 graphing calculators. The screen shots show data on an AT keyboard interface (at maximum sample rate), a Mac Plus keyboard interface and a 300bps serial connection (lowest sample rate). If you want to avoid the cost of buying a GraphLink cable to download the software to your calculator, point your browser at **http://linkcables.ticalc.org** and learn how to build your own for under $10!



Vasantha Crabb
Kyabram, Vic **$45**

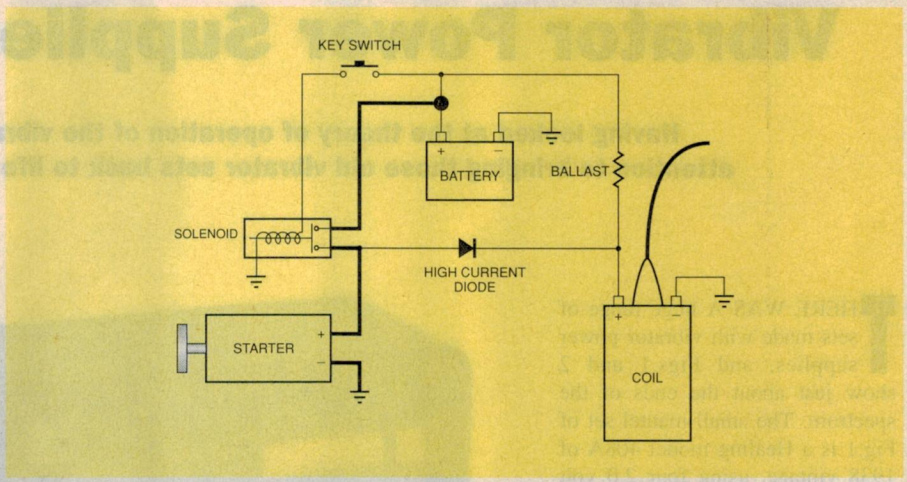
(Full source code for the logic analyser, along with a compiled 82P file and comprehensive documentation is available from the EA web site at ***www.electronicsaustralia.com.au*** as the file LOGIC10.ZIP, *or you can order it from our reader services dept. for $5 p+p)*

THIS MONTH'S WINNER!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is an open order to the value of $300 from Oatley Electronics! Yes, that's $300 to spend on anything you want from Oatley's wide range of products, so check out their ad (or their Website) to see what's on offer.

Win our 'IDEA OF THE MONTH' Prize!

Solid state ballast bypass for cars



I have a Citroen 1220 Club which, being air cooled and horizontally opposed, can be hard to start when hot. The ballast and coil have been modified so that when the starter solenoid is operated, it feeds a relay to bypass the ballast resistor, and thus supply 12V directly to the coil, hot or cold.

Unfortunately, the wiring on this particular car uses all grey wires: Grey with a black trace for positive, grey with a blue trace for negative. The result being that the above mod was installed incorrectly, and it kept the coil ballasted for hot starts, and fed it continuously with 14.5V when running... (So what's wrong with using *red* for positive?)

In my endeavours to sort this out, I came up with a solid state alternative to the relay: a high current diode.

When the pre-engagement solenoid supplies power to the starter motor, it also supplies power directly to the coil via the diode, bypassing the ballast. You might logically connect the diode from the keyswitch (as you would the relay) but failure of the diode while the car is running at speed could be rather dramatic. With the arrangement shown here, failure of the diode could allow the starter to be fed from the ballasted terminal of the coil, but this is of minor concern as the motor is disengaged and is running 'no load'. I applied a shorting link across the diode to test this situation and the ballast remained cool. Although the starter hummed audibly, it didn't scream.

Stephen Butcher
Masterton, New Zealand **$35**

Screecher II modification

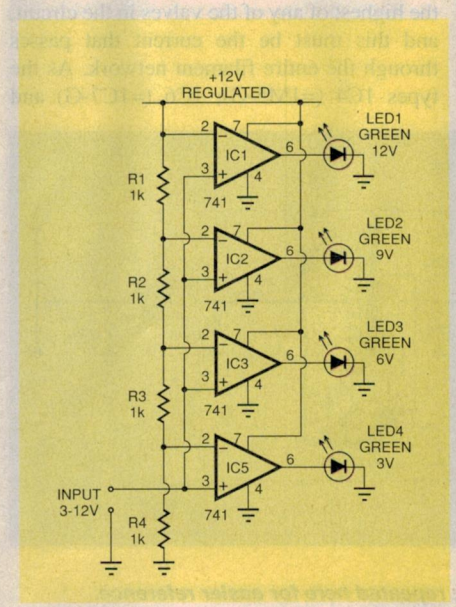
With the addition of two diodes, the flashing indicator of the Screecher II car alarm can be modified to give the user a visual indication of the alarm's status. This can be very useful when installing and setting up the alarm, as well as giving reassurance that the alarm is operating correctly during normal use.

The first mod is to add a diode to between pins 1 and 10 of U2. Solder the cathode to Pin 10, and the anode to pin 1. This prevents the warning LED from flashing until after the exit delay has timed out.

The second mod involves the addition of a diode between pin 10 of U1 and pin 1 of U2. The cathode goes to pin 1/U2 and the anode to pin 10/U1. This extinguishes the LED until the 'alarm time' has passed, and then reverts to flashing. This last mod is useful while setting up the alarm, as you may well be testing the unit without the siren attached.

Konrad Lojek
Toowoomba, Qld. **$30**

LED Voltmeter



Four 741 op-amps are used here to measure a voltage ranging over 3-12V DC. The voltage is displayed on four LEDs, and these indicate that the voltage exceeds 3, 6, 9 and 12V respectively. The inverting inputs (pin 2) of IC1-4 are supplied with 3, 6, 9 and 12 volts from the resistive divider chain made up from R1 to R4. The non-inverting inputs of all four op-amps are tied together and are connected to the meter's input terminals.

As soon as the applied voltage exceeds the reference voltage of one of the op-amps, it will bring its output high and activate the appropriate LED indicating that the voltage has been reached. While separate op-amps were used in this application, you could use a quad device, such as the LM324.

Raj. K. Gorkhali
Kathmandu, Nepal **$30** ❖

Vintage Radio

Vibrator Power Supplies - 3

Having looked at the theory of operation of the vibrator power supply, let's now turn our attention to bringing those old vibrator sets back to life and working as they were intended.

THERE WAS A huge range of sets made with vibrator power supplies, and Figs.1 and 2 show just about the ends of the spectrum. The small mantel set of Fig.1 is a Healing model 408A of 1938 vintage, using four 2.0 volt pre-octal valves, while the much larger console shown in Fig.2 is a substantial Healing dual wave model 668A, also of 1938.

As we are here to get the receiver going, a study of the filament network is a must. Refer to the circuit diagram of the Healing 408A's filament connections, shown in Fig.3. This series-parallel arrangement was fairly standard procedure for vibrator sets.

By the way, AWA had a most unusual practice of running the valve filaments from the 2V section of the accumulator, and then operating the vibrator cartridge from the 4V volt section. They surmised that the load on each portion was very nearly equal, and therefore the discharge rate would be likewise. It is assumed that this was also done to isolate the valve filaments from the ripple imposed on the battery by the vibrator action.

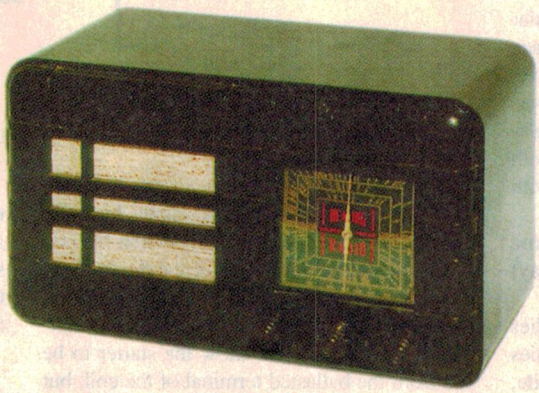


Fig.1: The Healing 408A four-valve mantel radio of 1938, which uses a vibrator power supply.

Looking at the 408A filament wiring, I don't know if the type 1D4 was designed with a series-parallel filament network in mind, but it certainly fits the bill (together with the octal equivalent, 1L5-G) very well, for reasons to follow.

The current drawn by the 1D4 is 240mA, the highest of any of the valves in the circuit, and this must be the current that passes through the entire filament network. As the types 1C4 (=1M5-G), 1C6 (=1C7-G) and 1K6 (=1K7-G) all consume 120mA, placing two of these in parallel will consume 240mA. If a parallel pair is then placed in series with the 1D4 and another pair again (or the 1C4 in parallel with an equivalent resistor, as shown), then each valve will be operating at its correct voltage and current. The equivalent resistance of any one 'leg' of this series network is therefore 8.33 ohms.

Note that in the event of the 1D4 having failed, none of the other valves will operate. However, should any one of the other valves have failed, the voltage distribution will be seriously disrupted.

The equivalent filament resistance of any of the other valves is 16.7 ohms. Should one valve fail, the total resistance of that particular 'leg' is now 16.7 ohms. Across six volts, this means that approximately 180mA flows through each leg. This means then that the voltage across the 1D4 is now 1.5V, the voltage across the leg with the two valves intact is also 1.5V, and the voltage across the remaining valve is therefore 3.0V.

It's therefore critical that before anything is done to a vibrator set, the valves should first be tested. Also, *never* remove a valve from this type of set while it's in operation.

In four-valve sets or larger sets that didn't fit into a neat series parallel scheme, ballast resistors are used to ensure that the correct current, and hence voltage, flows through each leg. So in a four-valve set like the 408A shown, typically using a 1C6, 1C4, 1K6 and 1D4 or their octal equivalents, a 16.6 ohm resistor was placed in parallel with the 1C4.

Notice how the filaments are wired, and in which order. This too is important. The voltage measured across the 1D4 is 2.0 volts, and because it's at the top of the series-parallel string the voltage at the neg-

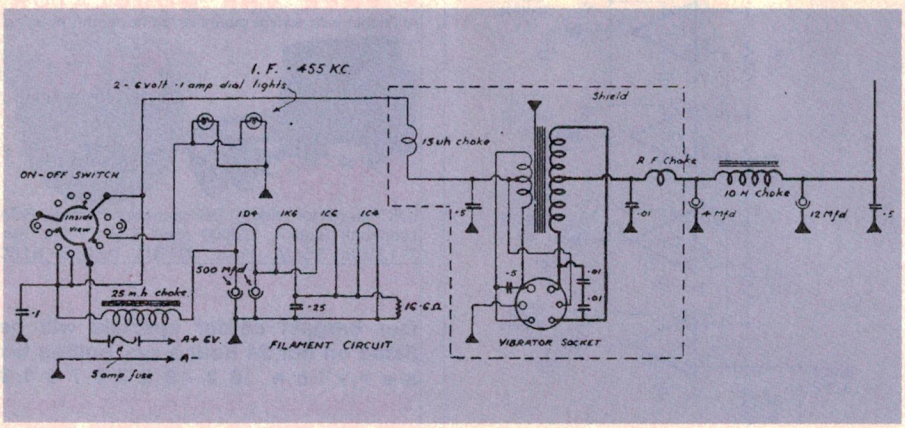
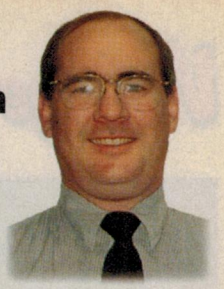


Fig.3: The power supply section of the 408A, repeated here for easier reference.



ative filament pin will be +4.0V with respect to the chassis.

This is in effect cathode bias. The cathode (filament) is 4.0 volts positive above earth, which places the grid (connected to earth via a 500k resistor) at -4.0 volts with respect to the cathode. This just so happens to be almost the correct grid bias (actually -4.5 volts) for a 1D4 operating at 135V on the anode. (It is for this reason that one wonders if the 1D4 was designed for a series-parallel filament network)

The next two valves down the chain are the 1C6 and the 1K6. Their cathode bias is 2.0 volts, compared to published figures of 3.0 volts. In this case, the figure is near enough. Further down the chain again, the 1C4 has zero bias, once again the correct figure. It is all very neat, as you can see.

Another critical point: it's essential that the signal detector diode in the 1K6 is the one surrounding the 'F-' filament pin, while the AGC diode is the one surrounding the 'F+' pin. Otherwise the AGC delay voltage will be incorrect, and signal diode will be too insensitive. So the actual polarity of filament connections can be quite important, too.

Fig.2: The Healing 668A dual wave six valve console set, also of 1938 and vibrator powered. It's a very good performer.

Supplying power

If the reader is seriously considering adding a reasonable array of vibrator radios to his or her collection, the purchase of a 6V accumulator is not a bad idea. They are rechargeable, and more importantly, totally authentic. Otherwise a regulated power supply of 3A capacity will be required, together with a B+ supply of between 120 and 140 volts (for testing before you get the vibrator supply going).

Now, let's say you've checked the valves and coils, replaced the electrolytic and coupling capacitors, then you hook it up to the 6V supply and nothing happens. Dead as a dodo.

First, check the fuse and the condition of the fuseholder. If there's still no result, disconnect the B+ lead from the main supply point, and remove the vibrator. Connect the battery leads to the 6V supply, and connect a lead from your external B+ supply, set to say 130V. We will assume that the set now works, so you can commence to repair the vibrator supply.

Repairs and tools

First of all, check the vibrator's coil for continuity. If it is intact, there is hope. If not, advertise, ring around or somehow scrounge another.

Assuming the coil is intact, the vibrator must be removed from its can. To do this, unsolder the little metal tag protruding from the base to the outside of the can, remove the retaining circlip, and carefully remove the cartridge.

Now *gently* prise the points apart and examine them. Do not disturb the parallel faces. Chances are they'll be pitted.

You will now need a 'points file', as used by motor mechanics for filing the ignition breaker points of car engines. They are available at large tool suppliers.

Carefully insert the file between a pair of points, and with the aid of a screwdriver blade, apply some even pressure on the outside contact. By carefully drawing the file to and fro, most of the muck and corrosion can be removed. This procedure must be done to each of the four points.

They must now be gapped. Using a feeler gauge and a pair of fine nose pliers, gap the primary points to about 0.015", ensuring that the tension is even and the faces of the points are parallel. Gap the secondaries to about 0.025", once again taking the same precautions as for the primaries.

Now without replacing the cartridge in its can, insert it in the socket (after re-connecting the original B+ wiring) and connect the supply. It should work. If much sparking is evident, switch off and re-examine — re-setting the points until you are satisfied that they are as accurate as possible.

Switch on again. If there's no sound at all, chances are the RF filter choke (in the B+ output from the transformer secondary) is burnt out. This can be checked easily enough, and replaced by sacrificing one winding from an IF transformer. Simply cut the four connecting wire pillars, unsolder the capacitor and coil connections, and with a hacksaw, cut the former. Use the slug and a couple of lock nuts if need be, otherwise fit it in as best you can.

The main HT choke may also be open circuit, as they sometimes are in mains-powered radios. If you can't scrounge another, try using one of the modern audio 'line' transformers (Jaycar Cat. MM-1900, or DSE Cat. M-1100), ignoring the secondary winding. In theory, these should really have an air gap because of the DC component, but experience indicates they work quite well.

The next job is to replace all the capacitors that are in circuit. The buffer capacitors should be 3kV disc ceramics, as advertised by the major suppliers. The other capacitors can be blue or green caps of equivalent value. The high voltage electrolytics can be obtained from RS Components, and 10uF/450VW are very useful for both mains and vibrator powered sets.

The chances of the LT chokes going open circuit are extremely remote. But if such does turn out to be the case, purchase a small reel of equivalent thickness wire from the major supply houses and simply wind a neat replacement.

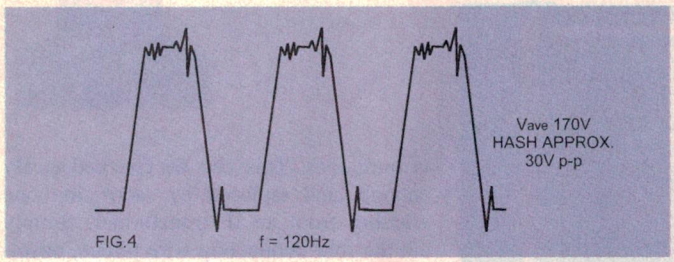


Fig.4: The waveform of this secondary voltage is satisfactory, but not perfect. The spikes in all CRO traces of vibrator waveforms are very faint, by the way; you need to examine them closely.

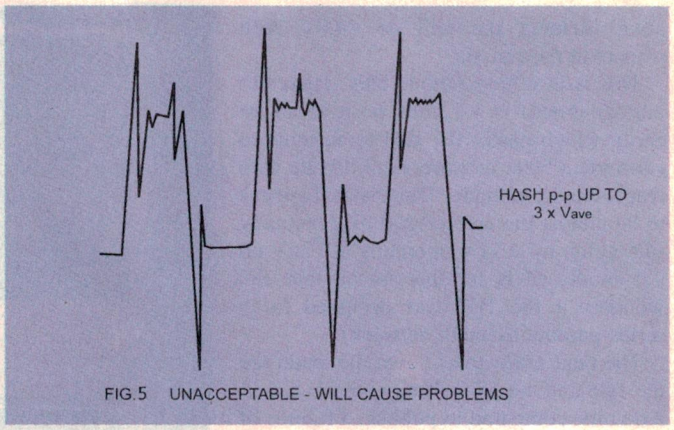


Fig.5: A representative secondary waveform showing inadequate buffering or badly adjusted points, or both.

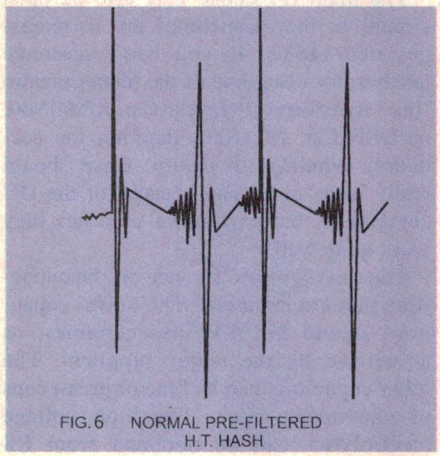
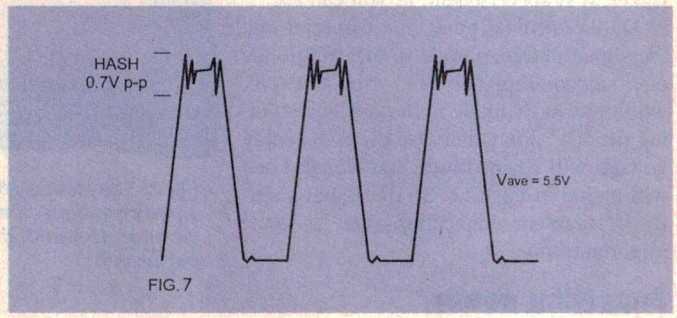


Fig.6 (left): The appearance of HT hash prior to filtering, at the transformer secondary's centre tap. This is fairly normal.

Fig.7 (right): The waveform across the primary points of the vibrator, with a minimally acceptable level of hash.



Using the CRO

Having done all this, the radio should work, but you'll ideally need a CRO to carry out the final adjustments. If sparking is still visible at the contacts, it will show on the CRO trace and will also be heard as audible hash.

If the sparking is *still* a problem, the cartridge can actually be dismantled by unscrewing the unfastening screws at the base. As the various components are removed, thread them along a straightened paper clip so that the precise order is not disrupted.

If needs be, the contacts can be ground flat on a fine oilstone block, ensuring that the pressure is as even as possible. If that doesn't stop the arcing, the points are probably too far 'gone', or else you will need to consult an expert!

Re-assemble the cartridge and re-gap the points. We will assume that the vibrator is now working satisfactorily.

As shown by your CRO, the waveform at one end of the transformer secondary with satisfactory secondary points will look like Fig.4, while inadequate buffer capacitors will produce a waveform as per Fig.5.

Fig.6 shows a waveform for the 'raw' B+ output (i.e., secondary centre-tap), prior to hash filtering. Without filtering, this hash can become quite audible. There is room for experiment with buffer capacitors across both primary and secondary, particularly if the gap has been altered from the manufacturer's specifications (which incidentally, are almost unknown).

Notice in the Healing circuit that both sides of the 1D4 filament are bypassed to chassis using 500uF capacitors. Bumping these up to 1000uF may also help reduce noise.

Voltage adjustment

The set screw and locking nut on the side of the vibrator framework, as shown in the photo two months ago, is there to alter the reed frequency. This will determine to a small extent the output voltage, but more importantly, it can have a particular bearing on the waveform shape.

You will need a 5/16" open spanner and a 1/8" screwdriver. Experiment with this adjustment by placing the CRO on the secondary.

In summary, you should aim for a satisfactory waveform that will ensure reliable life and hash free operation. This will depend on a combination of flat and parallel faces of the contacts, the correct gaps in each of the primary contacts and secondary contacts being as nearly equal as possible, plus the adjustment of the reed setscrew and the condition of the buffering capacitors, with perhaps some experiment for the best value. And finally, you'll almost certainly need new electrolytics.

Mechanical noise

In vibrators themselves, as well as their supplies, some quite elaborate steps were necessarily taken to reduce mechanical noise.

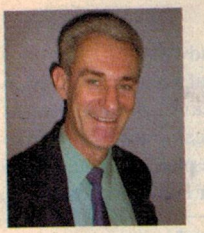
Firstly, the cartridge itself is generously mounted in soft rubber. Because this has remained relatively well sealed over the years, this rubber is quite often in nice soft condition.

Secondly, the vibrator socket is usually mounted in rubber grommets as shock absorbers.

Thirdly, the cartridge can is mounted inside another can (as a general rule) and some are even packed with cotton wool. All these procedures will become apparent as you examine and dismantle a given particular receiver for repair.

The acid test is to see how noticeable is the hum or noise when five to six feet away, with the volume turned to a comfortable level. If all is in order, noises of any kind will not be noticeable. Last but not least, performance of these sets is considerably improved if you use a good, moist and reliable earth.

Most people seemed to have avoided vibrator sets because of a lack of understanding. Hopefully these last three articles will help allay your fears. Think how your collection can be duly enhanced by the addition of more items of authentic radio history! ❖



Information Centre

by Peter Phillips

Digital vs electro-mechanical devices, & more...

We have a design flavour this month. Included in our offerings are the circuit diagram of a simple test device to check for continuity, shorts and opens between two telephone sockets, a discussion about using rotary switches and the problems associated with designing a video transmitter for a CCD camera. There's also a suggestion for an alternative power source, more discussion on charging deep cycle batteries and a letter describing a rather strange FM transmission.

ANYONE WHO HAS been involved in electronics for more than say 10 years will be aware of the way the field is continually changing. Many of these changes are genuine improvements, but some can tend to make life difficult, especially for a magazine like *EA* that produces construction projects. As many readers are aware, because of the problem of getting parts, some of which are relatively simple, quite a few of our past projects are no longer viable.

We do try to 'future proof' our projects, but as we don't have a functional crystal ball, this is often difficult. Another problem is finding suitable parts for projects, especially things like switches and other electro-mechanical devices that used to be commonly available. A good case in point is the design of the Receiver for the VNG Clock, published January 1999.

You might recall a letter in the April column about this design, in which the writer (Bruce Howard, of Collinswood) pointed out that a simple 3-pole 5-position rotary switch could have been used to replace some 40 components. However a number of readers have sprung to the project designer's defence, with the following letter being typical:

Switch limitations

Bruce Howard will have great difficulty purchasing the switch he describes. The nearest type will be a 3-pole 4-position switch, not the 3-pole 5-position type he needs. All rotary switches, unless specially made, are limited to a maximum of 12 positions, be it 1 x 12, 4 x 3, 3 x 4, 2 x 6 etc. (Glenn Percy, Melbourne, Vic)

Thanks for pointing this out, Glenn. As far as I recall, a much wider range of rotary switches used to be available, although it's probably been some years since you could buy almost any type you needed. So, to make the project possible, the designer (Peter Stuart) had to opt for another way. Of course, there are advantages in replacing an electro-mechanical device with pure electronic devices, as Peter himself points out...

Your correspondent, Bruce Howard, questions the number of components in the frequency selection circuitry of my VNG receiver, and suggests replacing them with a rotary switch.

From the beginning, I decided the receiver should use modern design concepts and readily available parts. Rotary switches virtually disappeared from commercial electronic equipment during the 1970s. Pushbutton digital control is almost universal these days. Anyone who has had problems with contact resistance in high impedance circuits using rotary switches will understand why.

There is nothing to prevent Mr Howard from modifying the circuit to use a 3-pole 5-position rotary switch. I wish him luck though, because none of the usual parts retailers stock them. (Peter Stuart, by email)

It would be interesting also to compare the costs of the 40 components and a suitable switch. It's possible the costs are similar, with the components giving the advantage of easier assembly, along with increased reliability. Anyone from the telecommunications industry will vouch for the increased reliability that solid state switching has provided, compared to the banks of relays and uniselectors of years ago.

However, sometimes a switch *is* the best way, as I found out some years ago when I attempted to design a circuit to switch between two printers and the parallel port of a computer. At the time I had purchased a printer switch box that did this, but was amazed (and amused) to see that it simply contained a huge rotary switch, hard-wired to the Centronics connectors on the back of the box. After trying to design a two-layer PCB to cope with the number of wires that needed to be switched, the ICs and other components, I decided the switch idea was much simpler and gave up. Furthermore, the little box with its switch is still giving sterling service.

Sticking with design problems, here's an interesting one from the owner of a small electronics company in New Zealand who needed to develop a means of testing continuity between two telephone sockets mounted on a printed circuit board.

Socket tester

Last year my company had to make 10,000 small boards containing two telephone sockets and a spark arrester, for use as a lightning arrester unit in computers. We could check the arrester visually, but we needed a tester for the sockets, as their failure rate was as high as 10%.

The problem seemed simple enough: design a tester to check the connections between two six-way telephone sockets mounted on a circuit board. The socket connections are straightforward, as pin 1 on one socket goes to pin 1 of the other, and so on. We wanted a tester that would give an audible indication if all socket

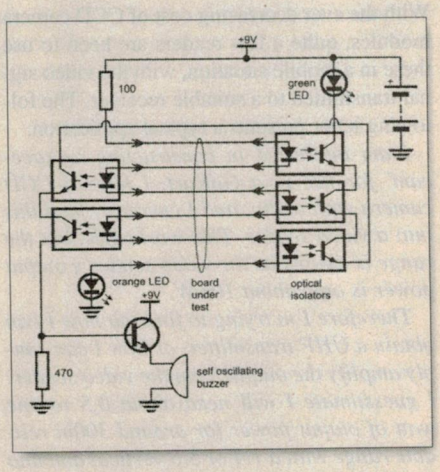


Fig.1: The circuit of a tester to check the connections between two PCB-mounted telephone sockets.

connections were OK, with some diagnostics to indicate an open or a short circuit.

It turned out to be a bit trickier than you might think. I ended up trying to design a microprocessor-based tester, but a friend of mine came up with a very simple circuit (shown in Fig.1). Of course there are probably other solutions.

As you can see, the tester doesn't have any switches and is battery powered. It has two cables attached to telephone plugs which have their retaining clips removed. The plugs are mounted so they face upwards and the board under test is pushed on top of the plugs. As soon as contact is made between the tester and a good board, the buzzer sounds. If there's an open circuit, both LEDs are off and the buzzer is silent. If there's a short circuit the orange LED will light. For a good board, both LEDs will light and the buzzer sounds.

The tester gave us a test time as little as two seconds. It could also be used for testing cables, although swapped wires would be hard to find. (Jake van der Peyl, Auckland, NZ)

THIS MONTH'S WINNER!

Jake intended this to be a What?? question, but as we tend to keep design-type questions to a minimum, I've presented it here. But I do wonder if there are simpler solutions. I'll be keen to present any that readers might come up with — but remember, your design must be simpler, and ideally should give a similar audible and visual indication of the condition of the circuit being tested.

Thank you, Jake, for sending us your tester circuit; it's an imaginative use of opto-isolators, it has diagnostic capabilities, and all without a microprocessor or even an integrated circuit!

Video transmitter

With the ever decreasing cost of CCD camera modules, quite a few readers are keen to use these in a mobile situation, with the video signal transmitted to a suitable receiver. The following letter presents a typical application.

I am interested in constructing a 'race-cam' for use in a GoKart. I have a CCD camera with audio, and I currently feed this into a video sender. This works OK, but the range is limited as the video sender's output power is only about 10mW.

Therefore I'm trying to find out how I can obtain a UHF transmitter, or how I can simply amplify the output from the video sender. I guesstimate I will need about 0.5 to one watt of output power for around 300m reliable range with a 1/4 or 5/8 vertical antenna on the GoKart. (Arran Coote, email)

Before I respond, here's another letter, this time from an engineering student:

One of the requirements for completing a subject I'm studying is that I must produce an electrical system. As part of this requirement I decided to choose a project that could transmit the output of a CCD camera attached to a remote control car. The signal could then be picked up by a nearby receiver, from where I can control the car.

Is it possible to transmit video signals on an audio transmitter, or is there a problem with the bandwidth of the signal? Perhaps you could advise me of a way of building such a transmitter and receiver, or point me to a website that can help. (Ian Firns, email)

At first glance, it might seem simple enough to build a video transmitter. But the problem becomes quite complex when a range of more than 10 metres or so is needed, as in a mobile situation. Perhaps the main difficulty is keeping it legal!

As most readers will be aware, the laws governing the use of the frequency spectrum are now very tight. We've seen the introduction of the C-tick, along with a very specific set of frequency allocations. Of course, you might be able to design a prototype transmitter, and even use it, as the C-tick approval only applies to manufactured goods, not developmental devices. You might even get away with using the wrong frequency, but the end result is likely to be a device that interferes with other services, especially if it outputs more than 10mW.

Commercial wireless CCD camera systems typically operate at around 2.4GHz (the allocated frequency), with an output power of 200mW or so. But these systems are expensive, because the transmitter needs to be very stable and designed to operate at UHF. They can typically transmit an audio signal as well, which adds to their complexity.

So the difficulties with building such a system include the need for UHF componentry, frequency stability to limit noise, adequate power output for a suitable range, and making it all small enough to fit into a mobile device. While certainly not insurmountable, these are very real problems for the home constructor.

To date we have not developed such a project, although Oatley Electronics is considering it as a kit. Commercial systems are presently available from Jaycar Electronics and Oatley Electronics (soon), but be prepared to part with a few hundred dollars. I haven't searched the Internet for this topic, but a useful search engine to try is **www.37.com**.

Getting back to Ian's letter, I suggest it would be difficult to transmit a video signal on a transmitter designed for audio. You don't mention the transmitting frequency, but given that a typical video bandwidth is a few megahertz, you would need something well above 100MHz. As well, the audio circuitry in the transmitter would need to be revised to widen its bandwidth.

However, it may be that a reader involved in amateur video transmissions can enlighten us on this issue. My practical knowledge of the field is limited, so I'd be pleased to hear from anyone who can help our correspondents.

Cloud power plant

The following letter is from a reader in Japan who proposes an idea for generating power using clouds as the source. It's untried, but our correspondent wants to share his idea with others:

These days most electrical power is generated by alternators. My idea is to generate power from clouds. I call the device a cloud power plant (CPP). The principle of operation is as follows.

Under rainy or stormy conditions, huge positive or negative electrical charges are formed in the clouds. These charges are conducted by an electrode to a large capacitor placed in the earth, but separated from the earth by insulators (plastic, porcelain etc). The capacitor is also connected to the earth with several fine wires. When a high power charge passes through these wires, they will fuse, trapping the charge in the capacitor so it's ready for use.

In practice, a metallic electrode could be placed in a very high place, such as on a hill or on top of a building. This electrode is connected by a thick wire to the capacitor placed in the earth. The pathway of charges from the cloud to the earth is: from clouds to the electrode, from electrode through thick wire to the capacitor, from capacitor to earth through the fine wires. When the fine wires fuse, the charge is trapped. (Dr Mohammad Jainul Abedin, Kagawa, Japan, email **abedin@kms.ac.jp**)

I can see a few practical issues making this concept somewhat difficult to realise, but the idea of tapping into 'cloud energy' is one that has been raised in this column before. I've included our correspondent's email address for those who would like to contact him.

Moving onto other matters, here's a letter from a reader who wonders how often the following problem occurs.

Strange FM audio

I was recently listening to a small local FM radio station that was transmitting test music with occasional announcements. Because I have only one ear working, I listen in mono, but when I switched to stereo I noticed something very peculiar: I could hear the announcements. Switching to mono during an announcement silenced it. The same was occurring with old mono music recordings. As well, stereo music suffered in various strange ways in the mono position, with the singer virtually disappearing.

Having apparently been first to spot this phenomenon years ago during test transmissions from two FM stations, one (ABC) AM

station and one TV station, I rang the new FM station. It took several calls, but my diagnosis was accepted with some grace: balanced lines in transmitters are easily reversed. However it was about 38 hours before the transmission was fixed.

Have others experienced this avoidable error? I've not read of it in EA or in any other publication. It could of course be quite a problem if the station was transmitting a service or important announcements.

I notice too that kits for cancelling voices on recordings for singalong purposes appear to be no longer available. This circuitry is incorporated in some stereo portables with karaoke facilities. (Sam Ross, Perth, WA)

An interesting problem, Sam. I guess many readers have experienced something similar, such as reversed speaker leads, or a reversed input channel, but not as a transmission problem. It's one to look out for.

Deep cycle batteries

In February, a reader (Stephen Butcher) discussed the problems of charging deep cycle batteries, a topic raised some time ago by another reader (Mr Gebhardt). The following letter is from a reader who disagrees with some of the points Stephen made:

Stephen Butcher says that the charge time for a deep cycle battery is huge when it's in parallel with the starter battery, due to the difference between their internal resistances. In a practical situation, the internal resistance of the batteries is irrelevant.

Starting the engine typically requires one or two ampere hours. Therefore the starter battery is virtually fully charged when the battery controller parallels it with the deep cycle battery, which because it has been used to power lights and appliances between engine starts, could have a terminal voltage between 11V and 12V. The alternator, which is current limited, increases the terminal voltage of the paralleled batteries to between 12V and 14.5V (the regulator voltage).

At 12V, if the deep cycle battery is substantially discharged, all available alternator current will flow into the deep cycle battery, as the fully charged starter battery will not accept a charge current at this voltage. As the deep cycle battery voltage approaches the regulator voltage, a holding current of a few amps flows to the fully charged starter battery. As the deep cycle battery becomes fully charged, the alternator supplies a holding current to both batteries.

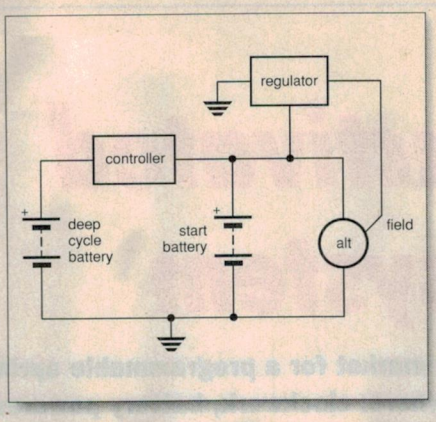


Fig.2: A basic dual battery charge system, as suggested by reader Carl Wilhelm.

I suggest Mr Gebhardt's caravan battery problem is due to the relatively long lead between the engine compartment and the caravan battery, via the controller and the caravan connector (assuming the deep cycle battery is in the caravan). If the controller has a solid state switch and additional series resistance, as in the EA January 1996 'Smart Dual 12V Battery Controller', then the deep cycle battery will have a huge charge time.

In my experience, the setup shown in Fig.2 is very satisfactory if the resistance between the batteries is kept as low as possible. (Carl Wilhelm, St Ives NSW)

Thanks for contributing to this discussion, Carl, it's one that seems to have been going for some time. Your mention of 'paralleled' batteries has me a little worried though. If two batteries are connected in parallel, the battery with the higher voltage will discharge through the other battery, until both have the same voltage. Therefore, connecting batteries in parallel is normally done with extra circuitry, such as an isolating diode.

Of course, the controller you mention might be responsible for this. Otherwise, I can't see how you can have the deep cycle battery in parallel with the starter battery without some form of isolation between them.

What??

We haven't had an op-amp question for a while, so here's one sent to me by the inexhaustible Bryan Maher:

For the circuit in Fig.3, given an ideal op-amp operating linearly from dual polarity

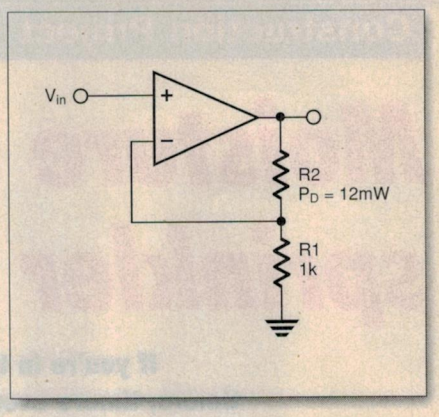


Fig.3: Find the closed-loop gain of the amplifier for the conditions shown. Assume an ideal op-amp.

15V supply rails, and given that the power dissipation in R2 is 12mW, find the closed-loop gain of the amplifier.

Answer to June's What

Two possible questions that can be asked of either tribesman are:

(1) "Which way to your tribe?"; Man takes the direction pointed to by the tribesman being asked. It doesn't matter who he asks, as the lying cannibal will point to the direction of the friendly tribe, as will the friendly tribesman.

(2) "Which way will the other tribesman say is the direction to the friendly tribe?" Man takes the opposite direction to that indicated. Again it doesn't matter who he asks, as both tribesmen will point the way to the cannibals. Think about it! ❖

Win this great Contrib of the Month Prize!

As an added incentive for readers to contribute to this column, we're now offering a valuable prize to the question judged most interesting, or the answer/response judged most informative, each month. The prize is a Mod-Col 38/54 high-res PAL colour video camera module from sponsor Allthings Sales & Services, with 450 lines of resolution, built-in digital signal processing, electronic shutter and auto gain control — valued at over $400!

Moisture activated sprinkler system

If you're in the market for a programmable sprinkler controller, it really is a case of timers, timers everywhere: clockwork, battery powered, water driven, 12V, 240V, one hour, one day, one week, 400 year, microcontroller based, PC driven — you name it. But how's this for a wacky idea: a sprinkler system that turns on when the moisture in your garden or lawn falls below a preset level. What's time got to do with it, anyway?

by Michael Jeffery

THIS LITTLE UNIT will automatically turn on your garden sprinkler system only when the garden or lawn actually *needs* watering, saving you time and money. It has manual override, as well as a light sensor to prevent the unit operating during the daytime, thus avoiding scalding your plants in the midday sun.

In the southern states of Australia, one of the biggest problems people have at Christmas holiday time is what to do with the pets and the garden. In some cases you may take your pet along with you, but you can't jam the garden in the back of the station wagon and head off. It can get very hot and dry in summer, and even if you drown your garden before you leave, you could still come home to find that your plants have carked it from the heat.

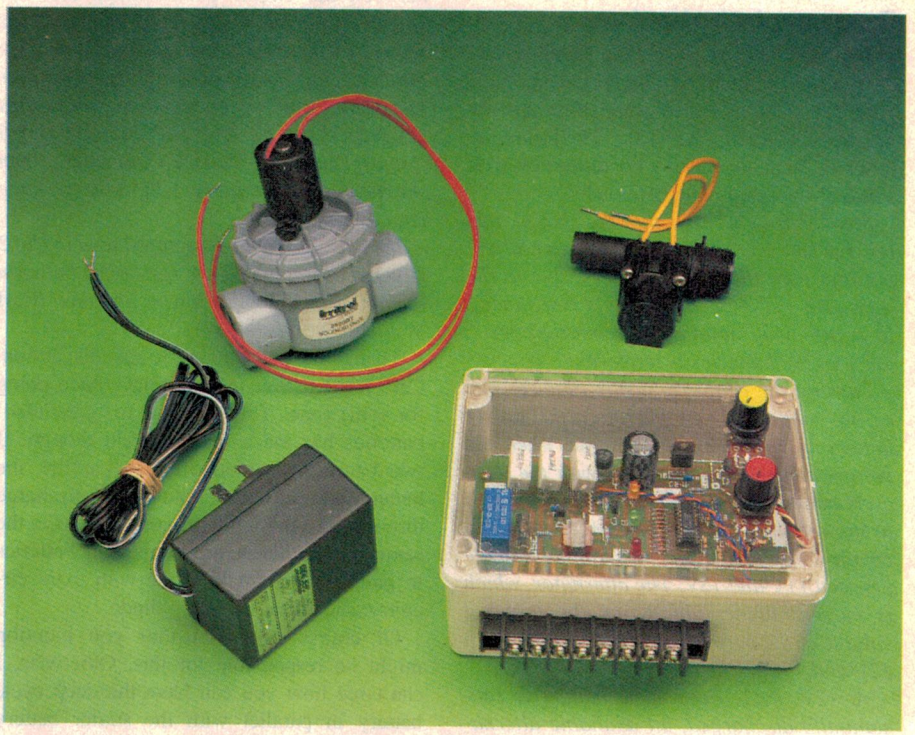
You can get some kind neighbour to water your garden for you, or you can rely on a timer to turn on your sprinkler system. If you use the latter, what do you do if it rains for three or four days in a row and the timer is set to water your lawn for two or three hours a couple of times a week? You'll not only waste water, but you may well return home to a very soggy yard.

As for trying to explain to a neighbour how to reprogram your Whiz-Bang (my VCR Remote has fewer buttons than this thing) sprinkler timer over the phone, forget it!

This design uses a probe to monitor the conductivity of the ground, and controls the sprinkler accordingly. No timers, no programming — and as it turns out, no buttons!

How it works

The heart of this unit is the LM3914 LED Bar/Dot Display Driver. The LM3914 has been used over the years for many projects, but this time we're using it to register the changes in conductivity of soil with different moisture contents.



A voltage proportional to the moisture content of the soil is produced by BR2, T1, and the two 1.2k resistors R3 and R4. The resistors limit the current through the transformer's primary, and the resulting secondary current flows through the probes (via the soil) and the bridge.

The reason we use an AC voltage across the probes is to prevent the electrolytes (salts, carbons, acids and alkaloids etc) contained in the soil from becoming polarised, giving false readings. As well, any DC current between the probes will set up electrolysis and eventually the probes will become corroded.

The rectified DC voltage from the bridge is then filtered by C8, and then flows through R5, R6 and VR2 to ground. VR2 allows you to adjust the 'Set Point', which is the level of 'dryness' at which the sprinkler's solenoid valve will be activated.

The signal input of the LM3914 is bypassed by the two 0.1uF monolithic capacitors C4, C5. These capacitors, along with C6, C7 and C8 add stability to the whole circuit, as the LM3914 does not like AC or unstable DC on its input pin while in dot mode. With a degree of ripple on the input, the chip will appear to light all of its outputs, or a group of them at once (actually they will flash on and off very rapidly).

Q1 is configured as an emitter follower, and it buffers the voltage from the probes, driving the 'signal' input of IC1 via R7. VR1 and R9 form a voltage divider which is con-

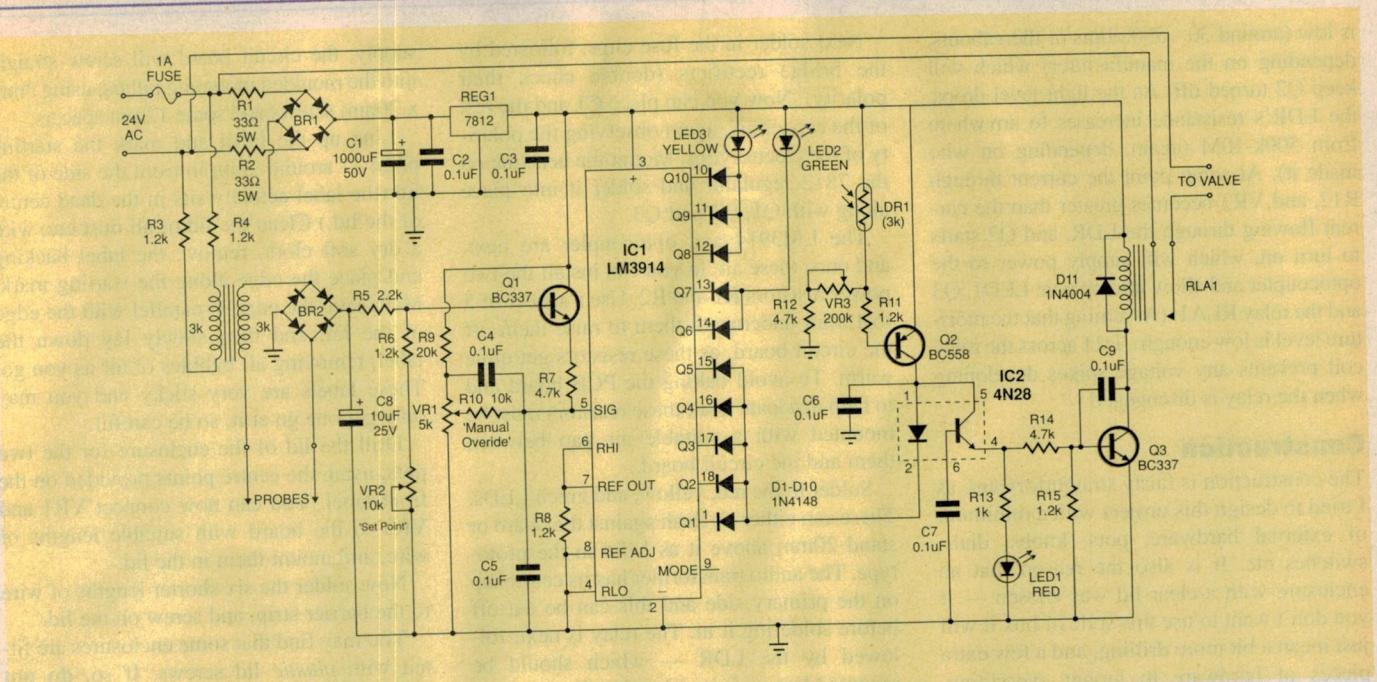


Fig.1: The circuit is based around a LM3914 LED driver IC operating in dot mode. The AC voltage from the probes is filtered, and the IC activates Q1 via the optocoupler if the soil is too dry. At left is a shot of the completed controller, along with a plugpack and two 24V solenoids.

nected across the supply rails to the signal input of the LM3914. This is the Manual Override adjustment, and turning this pot will allow you to manually control the sprinkler, regardless of the soil's moisture content.

The LM3914 senses voltage changes on its input pin (pin 5). The voltage on this pin is internally buffered, inverted, then tied to the inverting inputs of 10 internal voltage comparators.

A reference voltage is set up by an internal 1.25V reference source, which is fed to a string of 10 internal series resistors (a 10-tap voltage divider, as it were), where each successive tap is fed to the non-inverting inputs of the 10 internal voltage comparators.

As the voltage on the input pin rises, each comparator output will go low as its non inverting input matches the input voltage. This gives 10 outputs that go low in 10 equal steps, over the voltage range set by the internal reference voltage and the potential divider resistors.

Each voltage comparator output is capable of only sinking a maximum of 30mA, with R8 used to set the maximum output current. Pin 9 of the LM3914 selects either dot or bar mode. We don't want bar mode, so this pin is left unconnected.

So, with IC1 set up to run in dot mode, the outputs Q1 to Q10 are each pulled low in turn as the voltage on its 'signal' input rises. The wetter the soil, the higher the voltage on the input, and with the controller calibrated correctly, bone dry soil will send output Q1 low, 'just right' soil will send Q6 or Q7 low, while really wet soil activates output Q10.

The 10 outputs drive three separate OR gates, composed of diodes D1 to D10. The first of these gates (ORing the Q8, Q9 and Q10 outputs) drives LED 3, which therefore comes on when the ground is wet. Gate two (ORing Q6 and Q7) lights LED2 indicating that the moisture content of the soil is OK. Gate three ORs Q1-Q5, and this output controls the relay via the optocoupler IC2 when the soil is too dry.

The output of this last OR gate is fed to an optocoupler IC2, a 4N28 which in turn drives Q3 to operate the relay, and consequently the sprinkler solenoid valve. The output from the optocoupler also drives LED1, indicating that the soil is too dry. R15 allows LED1 to be partially lit before Q3 starts to turn on and power the relay.

The green and yellow LEDs (LED2 and LED3 respectively) have an extra pad on the circuit board in case you want to take a tap off to something else, such as an alarm. If you decide to do this, I would recommend that you use the optocoupler circuit that I used for the 'dry' output, as the LM3914 is difficult to interface with.

The rest of the circuit is mainly the power supply and the daylight sensing circuit. Firstly the power supply. 24V AC is supplied from a plugpack, and it will need to be able to supply at least 500mA as the pull-in current for most 24V solenoid valves is 300-400mA. (The holding current is usually a little less, at around 200mA.) The 24V AC is fed to the circuit via dropper resistors R1 and R2, to waste a small amount of voltage and make it more 'regulator friendly', and then go off to a fairly standard 12V regulated DC supply arrangement.

You may ask why use the voltage dropper if you are going to use a regulator? Good question.

When 24V AC is converted to DC, (as in this case) you end up with around 38V DC no load, which is pushing it a bit when it comes to maximum voltage input for a regulator. In the original prototype I tried to use an LM317T variable regulator (1.2 - 37V) which has a maximum input voltage of 40V DC, but it got too hot. I even fed the LM317T to an 7812 regulator and tried to split the heat difference, but they both ran very hot, which shows that there's no such thing as a free lunch when it comes to dropping voltage — heat is created and it has to go somewhere, and in this circuit the heat is spread over R1, R2 and the 7812.

When the relay pulls in, there is a voltage drop due to these resistors which prevents the regulator self destructing, and with even more load (such as an extension relay), the resistors get hotter and the regulator cools down. With the normal circuit load and only one LED on, both the regulator and resistors run quite cool as very little current is being drawn. (It is all a balancing act!)

The daylight sensor is made up of LDR1, Q2, R11, R12 and VR3. Q2 is a PNP transistor used to power the optocoupler, which will allow the relay RLA1 to be activated when the ambient light level is fairly low. R12 and VR3 are connected between the base resistor R11 and the negative rail, with the LDR connected between the base resistor and the positive supply.

With light falling on the LDR, its resistance

Moisture activated sprinkler system

is low (around 30 - 300 ohms or thereabouts, depending on the manufacturer) which will keep Q2 turned off. As the light level drops, the LDR's resistance increases to anywhere from 500k-10M (again, depending on who made it). At some point the current through R12, and VR3 becomes greater than the current flowing through the LDR, and Q2 starts to turn on, which will supply power to the optocoupler and allow it to operate LED1, Q3 and the relay RLA1. (Assuming that the moisture level is low enough). D11 across the relay coil prevents any voltage spikes developing when the relay is disengaged.

Construction

The construction is fairly straightforward, as I tried to design this project with a minimum of external hardware, pots, knobs, dials, switches etc. It is also the reason that an enclosure with a clear lid was chosen — if you don't want to use this style of box it will just mean a bit more drilling, and a few extra pieces of hardware to mount everything, including the three LEDs and a lens or protective cover for the LDR.

The circuit board is fully solder masked and silk screened, which will greatly assist in soldering the components onto the board. Start by placing all of the links and resistors (except for R1 and R2), then install the 10 signal diodes, making sure to get the polarity correct, as these diodes are fairly small and sometimes hard to read.

Next solder in the fuse clips, followed by the bridge rectifiers (double check their polarity). Now you can place C1 and the rest of the capacitors, again observing the polarity of the electrolytics. Mount the heatsink on the 7812 regulator and solder it into place along with Q1, Q2 and Q3.

The LM3914 and optocoupler are next, and once these are in you can install the two power resistors R1 and R2. Use a spacer of 5 to 15mm underneath them to raise them off the circuit board, as these resistors get quite warm. To avoid baking the PCB board and to help dissipate heat, these resistors must be mounted with a suitable air gap between them and the circuit board.

Solder in the red, yellow, and green LEDs. These can either sit flush against the board or stand 20mm above it as I did in the prototype. The audio transformer has its centre tap on the primary side and this can be cut off before soldering it in. The relay is next, followed by the LDR — which should be mounted last, as it is rather fragile.

Connect six short lengths of fairly substantial wire to the input and output pads along the front edge of the circuit board, and bolt the terminal strip on the corresponding side of the enclosure. (This will become the bottom of the unit when the controller is mounted on a wall.)

To align the front panel label, mount the PCB into the enclosure, and secure the lid. If you are using the plastic enclosure that I can supply, the circuit board will screw straight into the moulded mounting pillars, using 3mm x 20mm screws and some 12mm spacers.

Line up the label and mark the starting point — around 2mm in from the side of the lid (the label actually sits in the dead centre of the lid.) Clean the lid of all dust etc, with a dry soft cloth, remove the label backing and place the edge along the starting mark. Make sure the edge is parallel with the edge of the lid, and then slowly lay down the label, removing all bubbles of air as you go. These labels are very sticky and you may only get one go at it, so be careful.

Drill the lid of the enclosure for the two pots, using the centre points provided on the front label. You can now connect VR1 and VR2 to the board with suitable lengths of wire, and mount them in the lid.

Now solder the six shorter lengths of wire to the barrier strip, and screw on the lid.

You may find that some enclosures are fitted with *plastic* lid screws. If so, **do not over-tighten them**.

Powering up

Before applying power, double check the board for correct polarity on all components. With the Set Point and Manual Override controls both wound fully anticlockwise and with the probes removed from any soil, etc., turn the unit on and rotate the Manual Override control so that all the LEDs are OFF (e.g., so that the red LED has just gone out). If you briefly touch the probes together now, the red and green LEDs should flash and the yellow LED should stay on.

If all of the LEDs stay on or you get no response from the Manual Override control, check the resistor and links around pins 4, 5, 6, 7, 8 on the LM3914, as this is the most likely place to get problems.

The probes

The probes can be made from any two pieces of non-ferrous rod or wire, ranging from about 2.5mm to 5.0mm in diameter. In the prototype I used two 150mm long pieces of 3.5mm stainless steel rod. The length of the probes depends on how deep you want to monitor, so for most garden situations 100mm to 200mm would probably be fine. For a lawn you may only need 50mm to 100mm.

When you have decided on a length to use, sharpen one end of each probe slightly, then fit heat shrink sleeving to the whole length. (If you apply some glue such as contact cement before the heat shrink, it will prevent the heat shrink from sliding up the rod when pushed into very hard soil). Trim the heat shrink back to expose around 20mm from the pointed end and around 10-15mm from the other end. Only the tips of the probe should be exposed, otherwise you will only be measuring the water content of the top

Parts list

Resistors

(All 1% metal film unless noted)

R1,2	33 ohms 5W 5%
R3,4,6, 8,11,15	1.2k
R5,7	2.2k
R10	10k
R9	20k
R13	1k
R12,14	4.7k
VR1	5k linear pot.
VR2	10k linear pot.
VR3	200k 5mm horizontal trimpot.
LDR1	ORP12 light dependant resistor. (Or equivalent — 5-6mm diameter versions are not suitable. Use the 10-12mm version only).

Capacitors

C1	1000uF 50VW electrolytic.
C2,3,4,5, 6,7,9	0.1uF 50V monolithic
C8	10uF 25V electrolytic

Semiconductors

BR1,2	W04 400V bridge rectifier
REG1	7812 +12V regulator
IC1	LM3914 LED bar/dot driver (linear).
IC2	4N28 optocoupler.
Q1,3	BC337 NPN transistor.
Q2	BC558 PNP transistor.
D1-10	1N4148 small signal diodes.
D11	1N4004 power diode.
LED1	5mm red LED.
LED2	5mm green LED.
LED3	5mm yellow or orange LED.

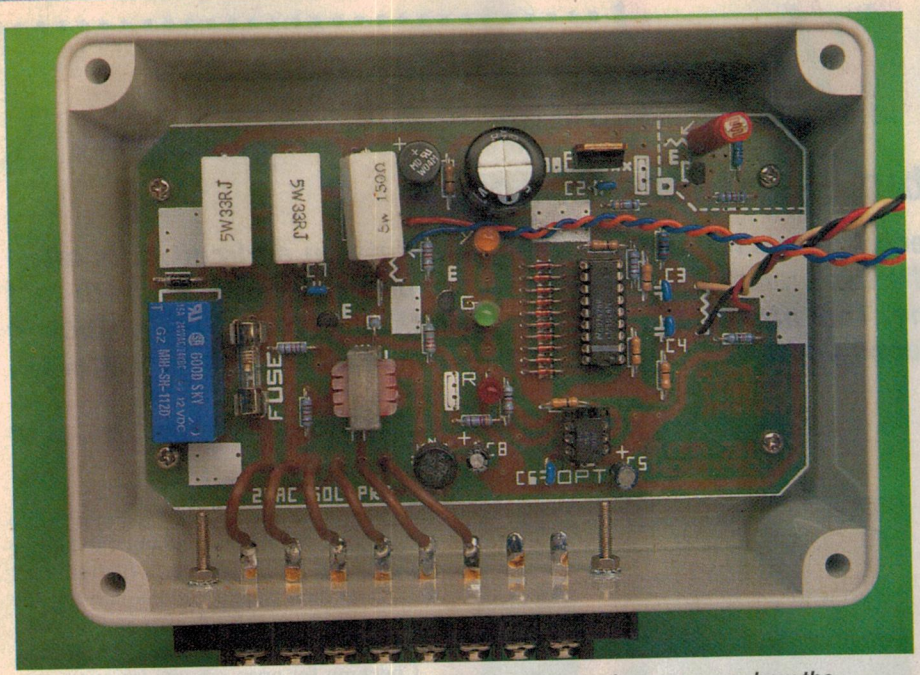
Miscellaneous

PC board 145 x 83mm; front panel label; TO-220 mini-fin heatsink; SPDT PC mount relay, 12V/16A; 3k/3k audio coupling transformer; 2 x PCB mount fuse clips; 1A fuse (M205); 8-way barrier style terminal strip; 6 x 3mm x 20mm metal screws; 3 x 3mm x 10mm metal screws; 4 x 12mm spacers; 3 x 3mm nuts and washers; plastic case approx. 170 x 120 x 90mm (preferably with clear lid); heat shrink or plastic sleeving; small disk of plastic or rubber see text); 24V/1A AC plugpack; 24V solenoid water valve (see text); set of probes (see text); 2 x 14-18mm knobs.

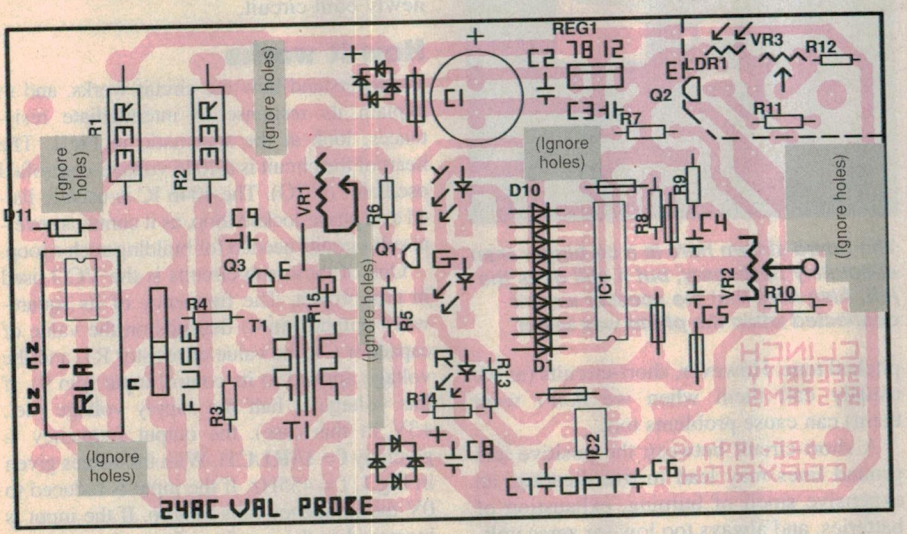
NOTE: A number of the parts required for this project are available from Clinch Security Systems. These are:

PCB (solder masked with component overlay)	$14.50
Front panel label	$2.00
Plastic enclosure with clear lid	$14.50
High pressure valve 1" bore	$34.00
Low pressure valve 19mm Bore	$24.00
24V AC plugpack	$21.00
Moulded probe assembly with 5m cable	$16.00
(custom cable lengths available, add $0.90/m)	
Postage and packaging in Australia	$9.95.

Send cheques or money orders to:
Michael Jeffery,
Clinch Security Systems
R.M.B. 5811
Myrtleford, Vic 3737.
Phone (03) 5756 2424.



Above is a close-up of the board mounted in the case, and you can see how the terminal strip is wired to the board. Note that this is a slightly earlier prototype, and so the layout has changed slightly. Use the component overlay diagram (below) when constructing the controller, and note that the two 33 Ω should be mounted 5-10mm above the board to aid heat dissipation. Also note that 0 Ω resistors are used instead of links in some cases.



10mm of soil and the unit will turn off after only a few seconds of watering.

The blunt end of the probes are inserted into one side of a length of terminal block, long enough to space them 20-30mm apart. The two probe wires from the controller are then inserted into the other side of the terminals.

It would be a good idea to waterproof the terminal block using silicone etc, to prevent water getting across the terminals and giving a false reading. Also to stop water running straight down the legs of the probes, cut out a small disk of plastic or rubber about 40-60mm diameter, then pierce the disk with the probes and slide the disk along the probes for the depth you require.

Setting it up

There are a couple of ways to set up this unit.

Firstly, the quick way. Water your garden or lawn to the desired level of wetness (let the water soak in and settle for a few minutes), then just to be on the safe side dig a small hole in the soil to a depth roughly where you want the probe to monitor. Now see whether it is actually moist there or not — sometimes the soil on top can be quite wet, but an inch or so down will be bone dry. In that case you may need a soil conditioner or something similar.

When you are happy with the moisture level, set the Manual Override to where NO LEDs are on (RED LED has just gone off) and insert the probe to the desired depth. Do not move the probes around after inserting them, as they will loosen the soil around them which will give a false reading. Now find the Set Point, using VR2 which will light up the green LED only, and that's it.

If the moisture level drops below this point by a even few percent, the valve will activate and the sprinkler will automatically come on. (You can disable the daylight sensor for setting-up by blocking it off with dark tape, etc.)

To set the daylight sensor function, adjust VR3 so that the relay will operate only at low light levels, but not pitch black. The onset of dusk is ideal.

The Set Point control will allow moisture content of around 5% to 30% be monitored, although very hi or low pH levels will drastically alter your readings. Adding some fertilisers or lime can cause this to happen, so apply your fertiliser, etc. before setting the unit up, or re-calibrate the unit after any additives are well watered in (in most cases anything you apply will increase the soil conductivity, which will prevent the valve operating).

If you want to get technical, completely dry out a sample of your soil in the oven, measure out 500ml or 1000ml of dry soil and tap the sample down on the table a couple of times to settle it. Then add the desired percentage of water (percent by volume) and place the whole mixture into a large jar. With the lid securely tightened, vigorously shake the jar for around 30 seconds. Check for dry lumps in the sample and make sure the mixture looks evenly moist. Put the mixture into a suitable plastic container (a tall tumbler or drink bottle with the top cut off), tap the container on the table a few times to settle it then set up as above.

With the unit set up properly, if the probes are removed from the soil none of the LEDs should be on, unless the Override Control has been adjusted too much. This will prevent the valve operating if the probes are accidentally pulled out. Also, with the probes pulled out it is possible to use the Manual Override to activate the solenoid valve or keep it from activating without effecting the Set Point, (but remember to set it back to where all the LEDs are OFF when you have finished). A switch could be used to break the circuit on one leg of the probes, allowing the Manual override to be used.

Also there are two styles of valve you can use: high pressure and low pressure. As a rough guide if you can stop the flow of water from your tap by blocking it off with your finger or hand without too much effort, you may need to go for the low pressure type. Most of the high pressure valves use the water pressure to turn themselves off, and some need a lot of pressure to work effectively.

Oh, and just one final tip: cactus may like 5-10% moisture, while 35-40% would be as close to quicksand as you can get. ❖

$10 Wonders

25 — Audible resistance checker

When you need to check the resistance between two points on a circuit, it is often quite tricky to watch the resistance meter yet keep the probes exactly on both test points at the same time. This project lets you concentrate on placing the probes in the right places and gives you an audible assessment of the resistance.

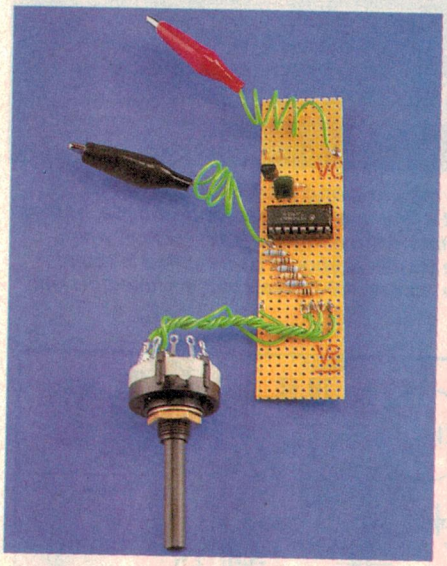
THIS SIMPLE resistance checker provides an easy way to determine one of three resistance levels between its test probes:

- Short-circuit — the two points are connected or there is a very low resistance between them.
- Resistance in range — the resistance between the points is within a switchable range.
- Open-circuit — there is no electrical connection between the two points.

The first and third levels are the ones we most commonly look for. When a circuit has been wired up, you may want to check that all appropriate points are directly connected to the power rail. For example, if the circuit has several ICs you will want to be sure that all the 'top right' (in most logic ICs) or all the 'pin 7s' (in most single op-amps) are connected to the positive rail.

Using this checker you place one probe on the positive supply input terminal. Then you run quickly through all the ICs, touching the other probe to their positive terminal pins and you expect to hear a high-pitched tone every time. Also, check any pins such as reset pins that should also be connected to the positive line. You can check connections to the negative or ground rail in much the same way.

Checking for short-circuits (or 'continuity' as we term it when the connection is one that we want) can then be extended to other circuit areas, particularly the lines linking the main parts of the circuit. In every case, you should hear the high-pitched tone. However, short-circuits (as we usually call them when we *don't* want them) can cause problems too.



The board shown here is a bit bigger than absolutely necessary, but it still does the job. Also note that the speaker wasn't connected when the photo was taken.

A short-circuit between the positive and ground lines may lead to over-heating, an expensive smell of burning, exhaustion of batteries, and always too low (or zero) voltage on the positive line so the circuit does not operate. To find this kind of short-circuit you touch the probes on the positive and ground terminals (without the power applied) and see if you get a high-pitched tone. You then isolate various parts of the circuit, test them individually, and gradually locate the unwanted 'short'.

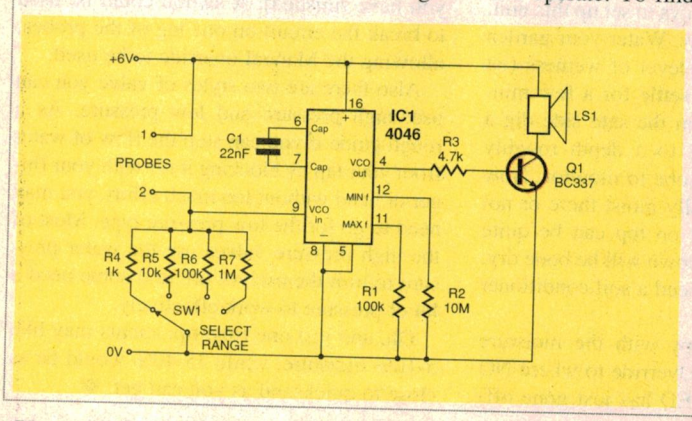
Checking for open-circuits (missing connecting wires, a burnt-out diode or transistor, poor solder joints) and short-circuits (incorrectly placed wires or components, splashes or thin threads of solder) usually accounts for the majority of problems on a newly built circuit.

How it works

To understand how the circuit works, and to explain its response to intermediate resistances, look at the schematic in Fig.1. The heart of the circuit is a 4046 voltage-controlled oscillator (VCO). The 4046 IC is usually listed as a phase-locked loop, as it contains several sub-circuits needed for building such a loop.

One of these sub-circuits is the VCO used in this project. The frequency of its square-wave output (pin 4) depends on the value of capacitor C1, the value of resistor R1, and the voltage applied to its control input (pin 9). If this voltage is half the supply voltage (i.e., +3V in this case), the output frequency is given by $\mathbf{f = 1/(R1.C1)}$. With the values given in Fig.1, f = 455Hz. If the input is reduced to 0V the frequency falls to zero. If the input is increased to the supply voltage, the output is increased to 2f, which in our case is 910Hz.

Rather than have complete silence when the



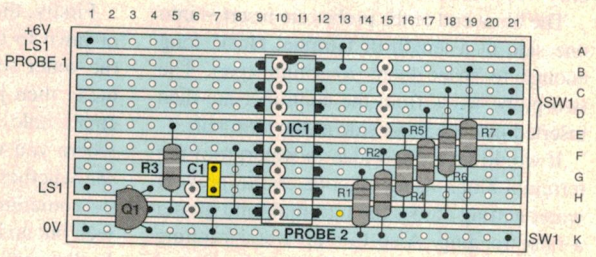


Fig.1 (left) shows that the 4046 VCO is doing all the work, with the output tone reflecting the resistance between the probes. Fig.2 (right) shows how to wire it up. Note the connections to the probes are at A1 and J13.

input is 0V, there is a resistor R2 that offsets the frequency range. The high value of R2 means that there is only a small offset of about 15Hz. So 0V produces a low-pitched 15Hz buzz, which is just enough to confirm that the circuit is actually operating. At the other end of the range, 6V produces a note of 925Hz.

Fig.1 shows that the resistance being checked is connected between the positive rail and one of a number of resistors. The range switch selects which one of these resistors is in circuit. On any range, an open circuit between the probes allows one of these switched resistors to pull the input at pin 9 down to 0V and the low-pitched buzz is heard. Also on any range a short-circuit between the probes pulls the input up to 6V and the high-pitched tone is heard.

To show what happens when an intermediate resistance is placed between the probes, we'll assume that SW1 is turned to put 10k resistor R5 into the circuit. If the resistance between the probes is close to 10k, the voltage at the input of IC1 is close to the half-supply level. The note generated is 470Hz (including the offset), which is easily distinguishable from 925Hz. If the resistance between the probes is greater than 10k the pitch is lower and, as it approaches 100k, the pitch falls to the buzzing level. If we now switch SW1 to bring R6 (100k) into the circuit, the input rises back up to half-supply and the pitch rises to 470Hz again.

Summing up, if SW1 is switched to a given range and a medium-pitch note is heard, the resistance between the probes is of the same order as the selected resistor. If you hear a buzz, switch to a higher range. If you hear a high-pitched tone, switch to a lower range. Switching ranges is necessary only if you want a (rough) measure of the resistance. If you are interested only in finding short-circuits or open circuits, you do not need to bother with setting the range.

The output from IC1 at pin 4 is fed through R4 to the transistor Q1. This is rapidly turned on and off by the signal from IC1. The current pulsing through the loudspeaker produces the buzz or tones.

Diodes, transistors

This circuit can also be used for checking diodes and transistors. If the anode of a diode is connected to the positive probe (1) and the cathode to probe (2), the diode will be forward biased. Current will flow through it and the input voltage to the IC rises, producing a medium-pitched note. When the diode is the other way round, no current flows through it, so the input is pulled down to 0V and a low buzz is heard.

We can check BJTs (normal transistors) in the same way, treating the junctions as diodes. For an NPN transistor's base-emitter junction, the base is the anode and the emitter is the cathode. For the base-collector junction the base is the anode (again) and the collector is the cathode. PNP transistors are much the same, only the anodes and cathodes are reversed. As a quick test, checking either type of transistor with the probes to the collector and emitter should give a buzz either way round.

Construction

The circuit is shown operating from a 6V supply. This can come from four 1.5V cells in a battery holder. Alternatively, you can use a 6V DC plug-pack. The circuit will also operate on 9V, so you can use a PP3 battery. The small size of a PP3 makes the project easier to miniaturize, but the operating cost is higher.

Although we have specified a single pole 12-way rotary switch for SW1, we use only four of its 'ways'. If you have a 2-pole 6-way switch or a 3-pole 4-way switch in your spares box, you can use this instead. Another way of switching is with a 4-way DIL miniature switch. Simply connect the four pins along one side to ground, and of the remaining pins on the other side to each of the four resistors.

There are no special problems with construction. SW1 is mounted on the case with its common terminal connected to point K21. The tags connecting to the first four rotary positions are wired to the terminals at B21, C21, D21, and E21. Remember to cut the strips at B15 to E15 and at the 10 other positions indicated in Fig.2. Also, note that the connections between A12-B12 and J9-K9 can be made with solder blobs if you like.

On the prototype, we used a pair of crocodile clips for the probes. You may prefer to use a pair of mini test clips, which are generally easier to attach to the pins of ICs. Or you may prefer a couple of banana plugs. ❖

Parts List

Resistors

All 5%, 0.25 W.

R1, R6	100k
R2	10M
R3	4.7k
R4	1k
R5	10k
R7	1M

Capacitors

C1	22nF, MKT or greencap

Semiconductors

IC1	CMOS 4046 phase-locked loop
Q1	BC337 NPN transistor

Miscellaneous

Miniature loudspeaker; Stripboard 25 x 53mm (10 strips x 21 holes); 9 x 1mm terminal pins; 16-pin IC socket, crocodile clips (black, red); battery clip or holder.

Experimenting with Electronics

by DARREN YATES, B.Sc.

Alarm circuits - 1

This month, we look at alarm circuits: how to roll your own, and new components that make building them easier.

WHEN WE THINK of alarms, we generally think about car or home alarms — even fire alarms — devices designed to make lots of noise to warn you when something you don't want to happen is happening.

These types of alarms are best left in the hands of professional designers, particularly when it comes to having them installed for insurance purposes. Most insurance companies these days recognise the benefits of installed alarms; however my bet is that if you told them you had a home-mode alarm design looking after your valuables, you wouldn't get much of a discount, if any.

However, there are plenty of other areas where homespun remedies can solve potential problems.

Alarm basics

IF YOU CUT it right down, an alarm circuit consists of a sensor, which when triggered, fires off the alarm warning sound circuitry. You can add various fancy features such as cut-off timers and even false-event detectors, but this is the basic make-up of virtually any alarm.

You can power them from either battery or mains, however for safety I'd recommend that you stick to plug-pack or battery-powered designs.

The sensors usually turn some physical parameter — whether it be light, sound, temperature, even gravity — into electrical voltage or a change in voltage, and generally enough so that it's easy to detect with fairly simple circuitry.

A circuit alarm

OK, enough talk. Let's get into some circuits.

Fuses are great protection devices to have, but it's not quite as easy to know when they've blown. This first circuit in Fig.1 detects a blown fuse, and is a simple one to add into any project. It uses just a handful of components, most of which you should have lying around in your junkbox.

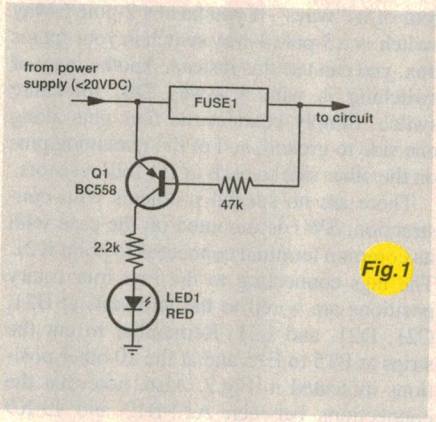


Fig.1

In normal operation, the fuse is good, the LED is out and the circuit basically does nothing. It's when the fuse blows that it springs into action.

Let's look at the fuse-good situation. When the fuse is good, it acts like a piece of wire so there is little voltage dropped across it. This means that the base of transistor Q1 is effectively at the same voltage as its emitter, so it remains off and the collector voltage is zero. With no volts across the LED, it stays off too.

When the fuse blows, and becomes an open circuit, the base-emitter junction of Q1 is now forward-biased by the (tiny) current flow through the junction and the 47k base resistor, turning it on. This pulls the collector up to the emitter voltage, lighting the LED to let you know that the fuse is blown.

As long as the transistor is rated above the voltage of the supply, everything should work well.

Simple light alarm

THIS CIRCUIT in Fig.2 detects a change in light levels. It simply sounds an alarm once the light level has fallen below a predetermined level.

This circuit relies on a light-dependent resistor or LDR. As its name suggests, LDRs usually work on the principle that as the light level rises, the resistance decreases.

Using a fixed resistor, the LDR forms a voltage divider feeding the non-inverting input of IC1a. As the light level falls, the voltage fed to pin 3 of IC1a, in this circuit wired as a comparator, rises.

Once it hits the reference point set by pot VR1, the comparator output snaps high, turning on the simple alarm circuit built around IC1b. Note here that the output transistors have been included in the feedback loop. Although not strictly necessary, it makes biasing easier.

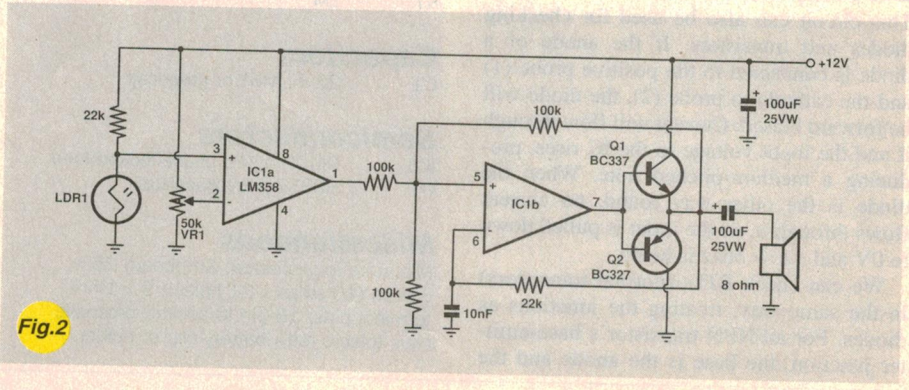


Fig.2

Note that the voltage reference for IC1a is a pot. LDRs are rough and ready devices, and you'll have to set it up to the right voltage by trial-and-error. Once set though, it should work well.

Note too that if you swap the LDR and the resistor connected to the non-inverting input of IC1a around (i.e., LDR at the top, 22k resistor to earth), you change the circuit from an alarm detecting light *decreasing* to one detecting light *increasing*.

IC1 is a common LM358 dual op-amp IC, although you could use half of an LM324 or even an LM393 dual comparator with some minor changes. It all depends on what you have lying around in your junkbox.

Temperature alarm

WITH THE CHANGE of only a couple of components, we can turn this circuit into a temperature alarm, as shown in Fig.3.

The new component labelled 'TH1' is known as a negative-temperature coefficient (NTC) thermistor. The 'NTC' bit simply means that as the temperature rises, the thermistor's resistance falls.

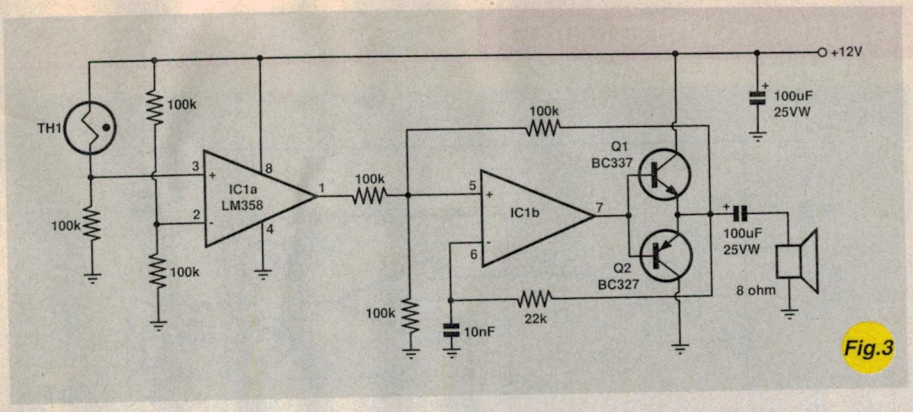


Fig.3

Most thermistors are of the NTC type. Positive-temperature coefficient (PTC) thermistors are less common, although if you're desperate for one, the humble light globe doesn't do too bad a job in some cases. In fact, miniature light globes are often used for this characteristic in very high-quality sinewave generators.

In our circuit, once the voltage rises above 25°C, the alarm starts up.

Thankfully, thermistors often have far more specific characteristics than LDRs. One sold by Dick Smith Electronics has a resistance of 100kΩ at 25°C, dropping by 5.2% for each additional °C.

By the way thermistors often don't change instantly — the Dick Smith unit has a thermal time constant of 17 seconds. They also have a temperature rating. This particular unit is good between -25° and +125°C.

Again, the same goes here as for the previous circuit, concerning the alarm sensing 'polarity'. Swap the resistor and thermistor around and the circuit detects when the temperature falls below a certain level. An obvious application here is a fridge-door-open alarm.

One important aspect about both LDRs and thermistors is that they are not high-current devices. Remember that as their resistance decreases, more current flows through them. Put an LDR across a car battery at night, and you'd most likely be OK. Do it in broad daylight, and it would fry in a second!

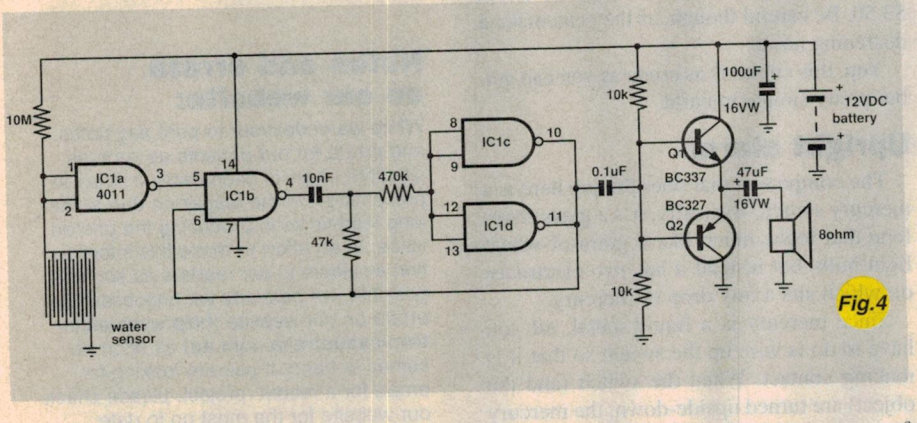


Fig.4

One thing to watch is the tolerance of the components. You may find that the circuit doesn't trigger until it reaches 26 or 27°C. This is due to the tolerance of the resistors used. If you need it closer to 25°C, use 1% resistors.

Water alarm

BECAUSE of its application, this next circuit should be used with batteries only.

There's nothing worse that leaving the clothes on the line, only to find out too late that it's started raining. Using a common 4011 CMOS quad gate IC and a piece of stripboard, it's possible to make a small handy alarm just for those questionable days. The circuit is shown in Fig.4.

The reason for using CMOS here is because of its inherent high-input impedance.

The stripboard is wired in a matrix or 'interleaved fingers' format, so that when a drop of water falls on it, the drop completes the connection, albeit at a high impedance.

There is still enough current flow for the circuit to trigger and fire IC1b, c and d, forming the alarm oscillator. Note that IC1c and d are in parallel to give the output more drive.

Two transistors at the output form a simple buffer amplifier to take the pressure off the CMOS outputs. Notice the transistors have no base bias arrangement other than pull-up and pull-down resistors. Basically, biasing isn't necessary. We're feeding the output with pretty much a straight square-wave, swinging to both supply rails. The transistors will switch on and off as required anyway.

Again, if you swap the input circuitry around as with the other circuits, this circuit can detect when water has disappeared instead.

Note too that you can use a 4001 CMOS IC with only minor changes. I'll leave you to figure them out, since we've covered most of this before. It's not too difficult, so experiment — after all that's what we're on about anyway.

Reed switches

ANOTHER INPUT SENSOR you could use is a reed switch. This is basically a magnetically controlled switch encapsulated in a thin glass tube. As long as the switch is in close proximity to an external magnet, it remains closed. Once the magnet moves, the switch turns off.

A common use of this type of input sensor is with sliding or swing-out windows. Reed switches are extremely thin — no thicker than a $2 coin — so you do need to take some care with them, but they do the job extremely well.

More practical to use are the solid reed switch assemblies that are available as a matched magnet and reed switch pair. You would use these by bolting the magnet half to the moving window and the reed switch unit to the window frame. They are much more robust than the open glass versions and not too much more expensive. Only $4 buys you a kit from Jaycar Electronics.

Crude SCR alarm

THIS ALARM (Fig.5) would be suitable as a simple trip alarm and uses a component we haven't used before. It's called a silicon-con-

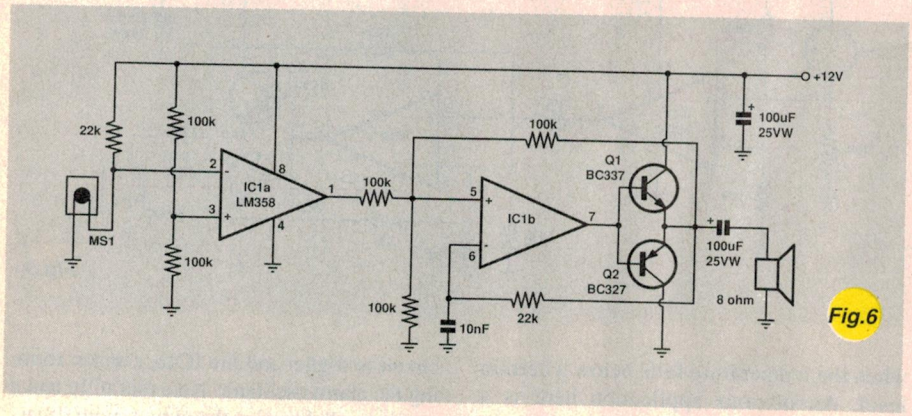


Fig.6

trolled rectifier, or 'SCR'. The one we've used here is a C106D1 type, available from Jaycar Electronics.

The basic way an SCR works is that while ever the gate input is below its set trigger voltage (which in this case is 0.8V) with respect to the cathode, the rectifier remains switched off. But once the voltage hits the trigger point, the device turns on and remains on. It remains like this as long as the cathode current is above 200uA.

And here's the trick: you can pull the control input below the trigger threshold, but the rectifier remains switched on. You have to interrupt the main current flow through the rectifier in order to turn it off.

SCRs have been around for donkeys' ages, and have been used in computer logic

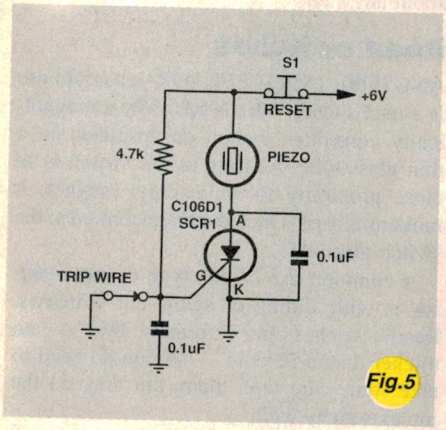


Fig.5

circuits among other things.

As you can see here, the capacitor connected to SCR1's trigger input is short-circuited by the trip wire. While ever the trip wire is in place, the SCR remains off.

But once the trip wire is broken, the current flow through the 4.7kΩ resistor charges up the 0.1uF capacitor. Once it reaches the trigger voltage, the SCR1 snaps on and sounds the buzzer or piezo alarm module.

The important thing is that the piezo module should be a continuous-tone type. Piezo alarms contain all the circuitry inside the module to make one heck of a racket. Now there are similar looking devices called audio transducers — you don't want these. They require extra circuitry on your part to make them sound.

Piezo alarms and buzzers simply need a DC supply voltage and they sound off straight away. Cheap ones start at about $3.50. Be careful though, as they can make a deafening noise.

Yep, this circuit is as crude as you can get, but pretty simple to build.

Upright alarm

The component that does the job here is a mercury switch. Basically, it's a glass envelope that looks much like a grain-of-wheat light bulb, but instead it has two electrodes on which sits a tiny drop of mercury.

Since mercury is a liquid metal, all you have to do is wire up the switch so that it is making contact. When the switch (and the object) are turned upside-down, the mercury away moves and no longer makes contact.

As before you can also wire MS1 up the other-way around electrically. In fact I would normally suggest using a make-to-sound the alarm technique, otherwise you have current flowing through the switch when the alarm is doing nothing. And since we hope the alarm does nothing for most of the time, this is just a waste of power.

Now mercury is dangerous stuff, so if you intend to use one of these things, please handle it carefully.

There are now 'bullet-type' mercury switches where the mercury is housed inside a steel chamber that looks like a bullet-head. These are more expensive but safer than the glass variety. I still wouldn't take them for granted though — mercury and people really don't mix.

Next time, we'll look at adding some extra circuitry such as delay timers, using key-locks, making multi-sector alarms and other fun bits and pieces. See you then. ❖

Notes & Errata

$10 Wonders - The Reminder (April 1999):
The component overlay diagram shows the base of Q2 connected to pin 14 of IC2, and consequently to the positive rail. A cut should be made in the strip board at hole B26, which isolates the base from IC2, and the circuit will then operate as designed. Our thanks to reader Norm Vella for bringing this error to our attention.

Low Cost RF Test Oscillator (Jun/May 1996):
In some cases the least significant digit on the counter display jitters, making the digit unreadable. This problem is easily fixed with the following mod:
Disconnect the reset pin of the 4024 (pin 2 of U5) from ground, and connect it instead to pin 13 of the 74C926 (U5). This will synchronize the input divider/prescaler with the counting circuit and the display should then become much more stable.
Our apologies for not publishing this mod earlier, but somehow it 'slipped through a crack' in our production system...

Notes and errata on our website:

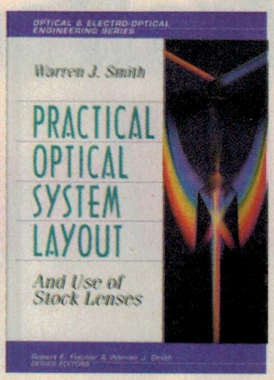
While we endeavour to print any notes and errata for our projects as soon as possible, there is necessarily a delay in presenting it in the magazine due to the long lead times in producing the printed issue. In an effort to make this information available to our readers as soon as possible, we post any yet unpublished errata on our website (**http:www.electronicsaustralia.com.au**) as soon as comes to hand. If you are looking for errata for a recent project, please check our website for the most up to date details. ❖

New Books

Optical system basics

PRACTICAL OPTICAL SYSTEM LAYOUT And Use of Stock Lenses, by Warren J. Smith. Published by McGraw-Hill, 1997. Hard cover, 235 x 157mm, 202 pages. ISBN 0-07-059254-3. RRP $165.

Nowadays an increasing proportion of electronic equipment also involves an optical subsystem of one kind or another. Typical examples that spring to mind are a CD or DVD player, with its laser-based optical pickup; an LCD projector, with its beam-splitting and combining optics; and a camcorder with both camera lens system and mini-CRT based viewfinder optics. So any design team embarking on a new project is likely to find itself having to look at optical system design as part of the overall challenge.



As the title suggests, this book is intended to provide a good practical handbook and reference, for this very situation. The author is a very experienced optical system designer and consultant, who is also a chief scientist at Kaiser Electro-Optics in the USA.

The emphasis is on how to achieve the desired optical performance, without having to delve too deeply into the theory of optics. This is fairly evident from the chapter headings: 1 - The Tools; 2 - The Basic Optical Systems; 3 - Condenser, Illuminators, Photometry etc; 4 - System Limits: Performance and Configuration; 5 - How to Lay Out a System; and 6 - Getting the Most Out of 'Stock' Lenses.

It's all written in down to earth, easy to follow text, with plenty of diagrams and only the maths that's really needed for the job. In short, then, it seems a very practical introductory handbook for those who need to tackle design of optical subsystems.

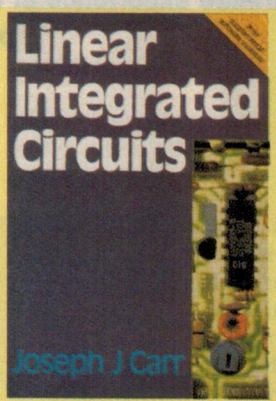
The review copy came from McGraw-Hill Australia, PO Box 239, Roseville 2069. (**J.R.**)

Linear ICs

LINEAR INTEGRATED CIRCUITS, by Joseph J. Carr. Published by Butterworth-Heinemann (Newnes imprint), 1996. Soft cover, 156 x 232mm, 332 pages. ISBN 0-7506-2591-6. RRP $55.

This prolific US author has written a number of books about linear ICs, including one we reviewed recently titled *Linear IC Applications*. So does this new book cover the same ground? In some ways it does, but with one important difference: this one covers the *theory* behind linear ICs, rather than showing how to use them — making it a useful companion to the first.

It's essentially about op-amps, and op-amp circuits. But while there are many books on these devices, this one also covers contemporary devices, such as UHF and microwave op-amps. It also has a chapter on DC power supplies for linear circuits, which discusses zener diode regulators, and of course the ubiquitous three-terminal regulator. Otherwise, the topics are typical of those found in any book on op-amps.



The treatment is fairly in-depth and mathematical, putting it at technician level rather than beginner. It's designed as a textbook, with test questions at the start and end of each chapter. The topics include basic op-amp circuit configurations, practical op-amps, differential, instrumentation and isolation amplifiers, and waveform generator and waveshaping circuits. It also covers current-difference (Norton) devices and transconductance op-amps (where the output *current* is related to the input voltage) as well as conventional types. And as already mentioned, a complete chapter is devoted to RF op amps.

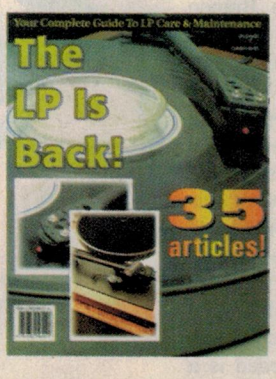
The ICs described in the book are mainly those used today, although the venerable 741 is mentioned quite a bit. It doesn't include any op-amp data sheets, but it does discuss the parameters of various op-amps throughout the book. The writing style is technical but friendly, there are numerous examples, diagrams and photos, and the book comes with a free software offer. The software can be downloaded from Butterworth-Heinemann's website **http//www.butterworth.heinemann.co.uk/carr/carr.html.**

The review copy came from Butterworth-Heinemann, PO Box 251, Port Melbourne 3207. (**P.P.**)

Analog audio

THE LP IS BACK! Your Complete Guide to LP Care and Maintenance. Published by Audio Amateur Press, 1999. Soft cover, 267 x 203mm, 160 pages. ISBN 1-882580-21-4. US Price US$7.95.

After passing through a nadir in popularity and esteem shortly after the introduction of CDs, the vinyl 'LP' recording and its associated analog technology seem to have made something of a comeback in the last few years — albeit mainly among a sub-group of the hifi fraternity, who believe that LPs gave 'sweeter' reproduction. I suspect another reason for the renewal of interest in optimal LP care and reproduction has come with the availability of low cost CD-R writers, making the prospect of transferring material over from LPs much more attractive than before — but at the same time requiring a good LP replay setup.



This new one-off book by innovative US publisher Audio Amateur Press/Old Colony Sound Lab seems to a selection of classic articles from their well-known magazine *Audio Amateur* and others, dating from the heyday of the LP in the 1970s. It includes articles on cartridges, stylii, preamps and pre-preamps, arms and tracking, equalisation, home-brew disc cleaning systems, record storage racks, turntable drive systems and electronic speed controls, DIY tonearms and tonearm mods, vibration damping systems and so on. There are 35 articles in all, covering many aspects of LP and analog disc reproduction.

It's all well written and easy to follow, and although some of the pictures are a bit dark in this printing, I'm sure those with an interest in this area will find it both irresistable and well worth getting.

It's available direct from Audio Amateur Publications via e-mail order, to **custserv@audioXpress.com**. More information on this and other AAP publications is also available from their website at **www.audioXpress.com**. (**J.R.**) ❖

Low cost approach to building your own...

PC Controlled X-Y Plotter

Always wanted to build your own PC controlled X-Y plotter — or three-axis engraving machine? It can be done at surprisingly low cost, using shareware and parts from the 'distress sale' printers currently available from Oatley Electronics. It's a good way to get worthwhile experience in computer control of machinery, although you'll need to be prepared to work out some of the fine details for yourself.

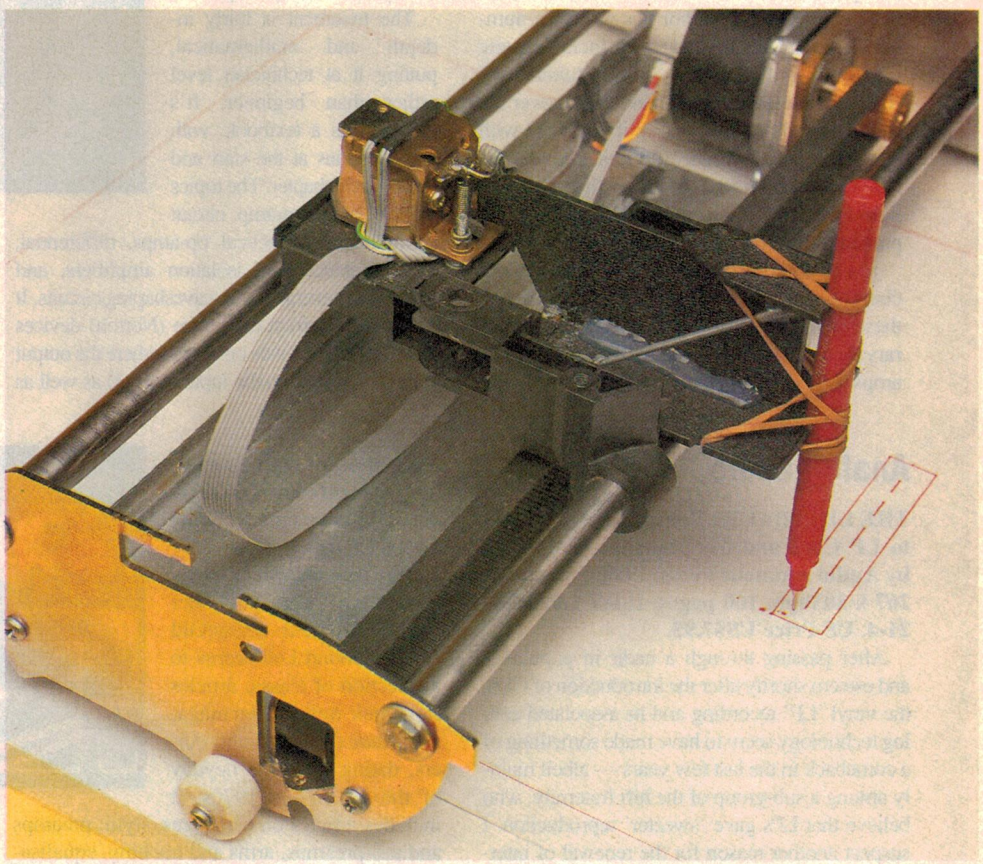
by Jim Rowe

LAST MONTH, you may recall, I told you about the high quality, brand new and never used German-made printer mechanisms that Oatley Electronics acquired at a 'distress sale' auction, and now has available for only $45 plus postage. Beautifully made, they're a terrific source of precision electromechanical parts — stepper motors (six), toothed pulleys and non-stretch drive belts, rollers, bearings, precision-ground slide and spacer bars, cams, actuator levers, microswitches, optical sensors and so on. There's also a compact switch-mode power supply module, a motor and solenoid driver board and various other electronic parts.

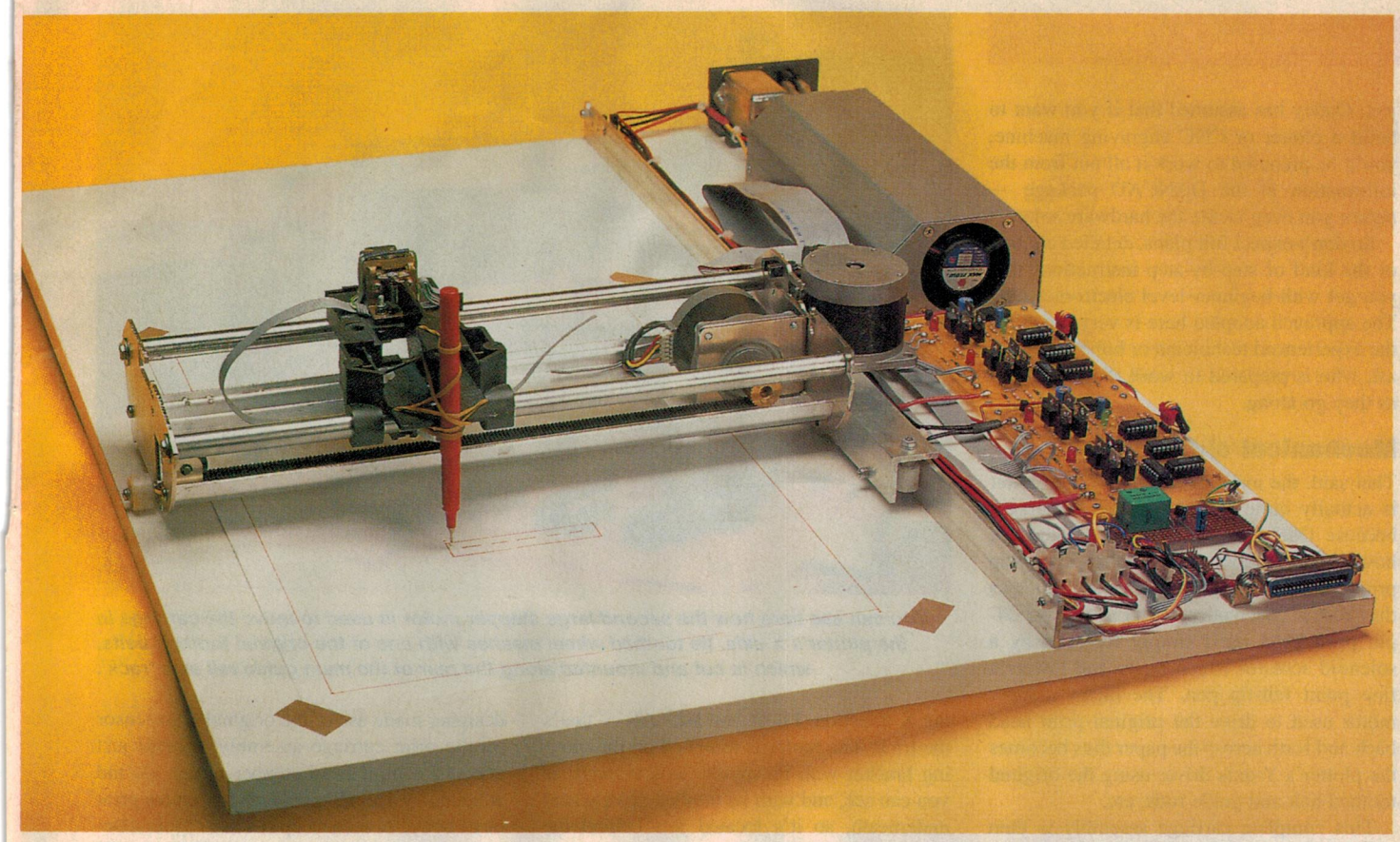
I also mentioned that Oatley's Branco Justic and his team had worked out a way of using parts salvaged from one of these printers to make a simple PC driven X-Y plotter — or even a light duty three-axis engraving machine, of the kind used to engrave plastic panels or route prototype PC boards.

As soon as I saw their prototype of this plotter/engraver, I sensed that it would be of particular interest to many of *EA*'s readers. That's because unlike many similar projects, it doesn't call for a lot of fancy machine tool work using a lathe or milling machine (or welder). In this case all that's needed is a hacksaw, file and drill, plus a few spanners and screwdrivers.

Nor does it need a lot of hard-to-get materials. Apart from parts salvaged from one of the printer mechanisms (including virtually



As you can see from this closeup, the Y-axis mechanism uses the original printer carriage from one of the surplus printers, intact apart from replacement of the 24-pin printhead with a simple scheme to raise or lower a fine-point felt pen.



the complete print head carriage assembly, which is used largely 'as is'), all that's needed on the hardware side can be obtained from most big hardware stores. You need about 950mm of 25 x 25 x 3mm aluminium 'L' angle extrusion, a piece of melamine-covered 16mm chipboard about 700 x 550mm, some self-tapping screws and some machine screws and nuts, etc.

On the electrical side, you'll need some terminal strips and lengths of ribbon cable — plus a couple of low cost stepper-motor translator/driver kits based on power FET bridges, which are also available from Oatley Electronics. For a further $9, Oatley can also supply a set of construction notes and drawings to 'get you started' in building the plotter, on a 3-1/2" floppy disk.

What about the software needed, so your PC knows how to control the plotter and put it through its paces? As mentioned last month, that's where Branco and his team pulled their second rabbit out of the hat, because the plotter has actually been designed to work with DANCAD 3D, a shareware package that's readily available on the internet (from **http://www.metal-working.com**, for example).

DANCAD is a DOS-based package that runs even on a 286, and is essentially a very powerful CAD/CNC control program; it can control stepper motors for up to four axes of movement, sense 'home' and 'limit' switches, 'pause' buttons and other sensors, and control relays — all via one standard Centronics-type printer port.

So thanks to Oatley Electronics' astute buying and imaginative flair, the nett result is that there's now a way to build your own low cost PC driven plotter/engraver, using simple tools that most readers are likely to have on hand. The overall cost should certainly be less than $150, and you'll be able to get valuable 'hands on' experience with computer control of simple machinery.

Looking closer

The general construction for the basic plotter prototype built by Oatley — to demonstrate what's possible — is apparent from the photos. It's built on a 700 x 550mm rectangle of melamine-covered chipboard or (preferably) MDF, with the electronics along one of the longer sides and the rest of the board area used for the plotting 'table', which can basically accept sheets of paper up to A3 size.

(The base board could be made smaller, if you mounted the electronics separately, or perhaps underneath. However this sort of refinement is left to you; Oatley's prototype is simply meant to show the basics.)

As you can see, the switchmode power supply from the printer is used to power the plotter, and was simply 'transplanted' to the back left of the baseboard. The mains input socket/filter and switch were also removed from the printer, and attached to an L-shaped plastic bracket cut from the bottom rear of the printer case, which is bolted to the rear left corner of the board. The input leads from the power supply were then connected to them, with all 'live' connections shrouded properly in 'heatshrink' sleeving to prevent accidental shocks. The mains earth is connected to the green wire of the power supply.

The two stepper-motor driver boards are located at the centre rear of the board, along from the power supply. Then at the end there are two small interface boards built on pieces of stripboard, the larger of which is used to operate a small relay which drives the plotter's pen solenoid, and the smaller a logic interface for the plotter's two opto-sensor 'home' switches. Finally at the right-hand end of the rear there's a Centronics-type 57N36 connector used to connect to the PC via a standard printer cable. (Which type of connector you use here is actually up to you, and the printer cable to want to use; the DANCAD software is quite happy with connections via a DB25 socket, if you prefer.)

By the way, the connections to the various boards, etc., are not shown here and are covered only briefly in the notes supplied on disk by Oatley. That's because the complete design is based very heavily on the DANCAD shareware package. As well as providing the software to control things like a plotter or machine tool from a PC, the package also gives a lot of information on stepper motors, driving circuitry and sensing arrangements you'll need for this type of pro-

ject. Oatley has assumed that if you want to build a plotter or CNC engraving machine, you'll be prepared to work it all out from the information in the DANCAD package — *before* you even tackle the hardware side.

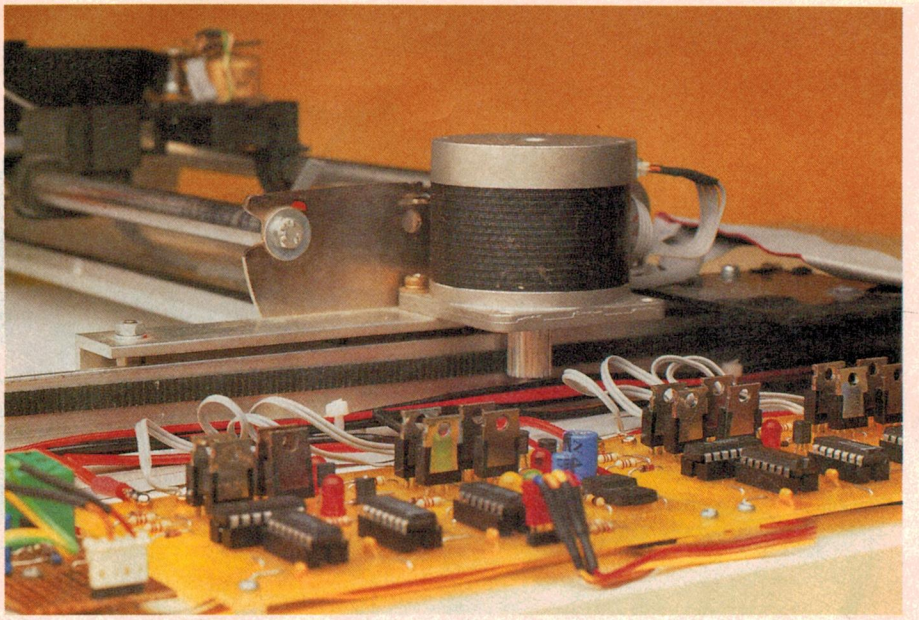
So don't expect full plans, detailed circuits or the kind of step-by-step instructions that you get with beginner-level electronics kits. The approach adopted here is very much for the experienced technician or hobby enthusiast, who is prepared to work the details out as they go along.

Mechanical side

That said, the mechanical side of the plotter is actually quite straightforward — largely because Oatley's designer has worked out how to use almost the complete swing-up print carriage assembly from the printer as the 'Y axis' mechanics, with the original 24-pin print head itself simply replaced by a solenoid actuator which raises and lowers a fine point felt-tip pen. The husky stepper motor used to drive the original print head back and forth across the paper thus becomes the plotter's Y-axis drive, using the original toothed belt and guide rods, etc.

This complete carriage assembly is then rolled back and forth along a single 'guide rail' made from a 700mm length of 25 x 25 x 3mm aluminium angle, to achieve the X-axis drive — using the second larger stepper motor from the printer.

The X-axis drive system *does* have to be fabricated, but here again the designer has been very ingenious. One end of the original print carriage (the 'front') simply rolls along the front of the base board, using as a wheel one of the 18mm diameter rollers salvaged from the printer mechanism.



You can see here how the second large stepper motor is used to move the carriage in the plotter's X-axis. Its toothed wheel meshes with one of the original toothed belts, which is cut and mounted along the rear of the main guide rail as a 'rack'.

But how does the second stepper motor actually drive the carriage back and forth in the X direction? Ah — that's the trick!

At the other ('rear') end of the carriage is attached a bracket cut from a second 250mm length of the 25 x 25 x 3mm aluminium angle, which supports both the X-axis stepper motor and four more guide rollers: two more 18mm rollers to roll along the baseboard, and a pair of 12.5mm rollers to roll along the vertical 'front' of the fixed guide rail. All four rollers and their spindles are again salvaged from the printer, and one of each pair are located near the ends of the 250mm 'moving bracket', to provide the moving carriage with maximum stability as it rolls along.

But how does the second stepper motor actually drive the carriage back and forth in the X direction, I hear you ask? Ah — that's the trick. The motor is mounted on the moving bracket with its spindle axis vertical, as you can see, and with its toothed drive wheel underneath, so it's located just behind the fixed guide rail when the carriage is in place (whereas the various rollers are all in *front* of the rail). And one of the original toothed belts from the printer (marked '426AG') is cut and mounted along the rear vertical surface of the fixed guide rail, using a simple metal clamp at each end. The former belt thus now becomes a toothed 'rack', with which the teeth of the stepper motor wheel can be mated.

The stepper motor mounting screws are 4mm in diameter, while the holes in the motor's mounting flange are 5mm in diameter. This allows the stepper motor's exact position to be adjusted carefully on the moving carriage bracket (before the screws are tightened), so that its wheel teeth mesh nicely with the belt 'rack', and the belt is under a small amount of compression. When this is done the motor is able to move the carriage back and forth smoothly and accurately.

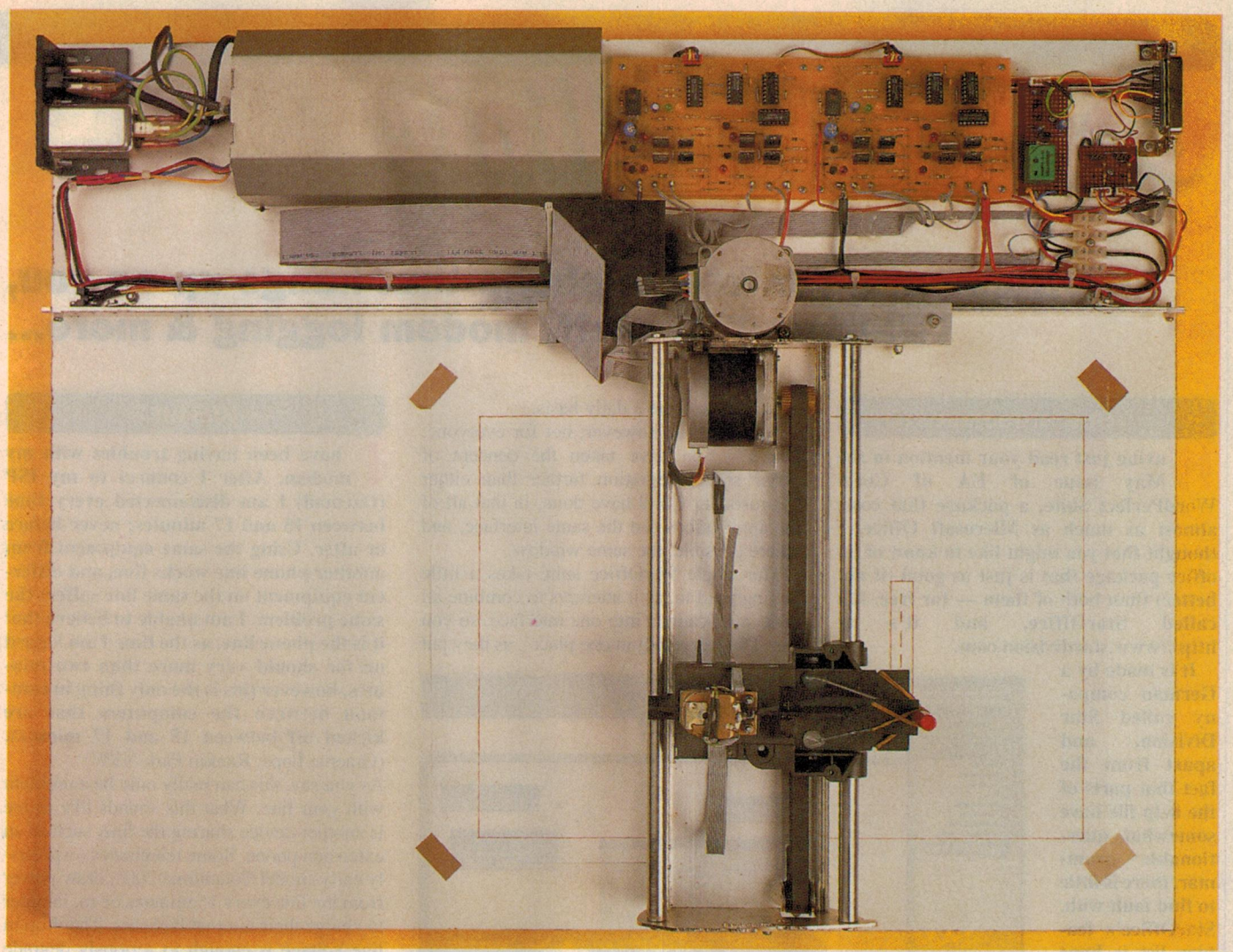
Hopefully the photos we've taken of the prototype will make most of this clear. If you buy the Oatley 'plans' disk you will also get a drawing of the main critical part: the angle bracket that mounts on the end of the print carriage, and supports the X stepper motor and guide rollers.

For the 'Y home position' switch, Oatley's designer made use of the original opto sensor on the print carriage assembly, located just above the print head stepper motor — and actuated by a small moulded 'fin' on the print head body. A second opto sensor from elsewhere in the printer was salvaged for the 'X home position' switch, and this is mounted on the back vertical surface of the main guide rail of the prototype, near the extreme left-hand end (about 22mm in, actually). It's actuated by a small 'L' shaped bracket of light sheet metal, attached to the left-hand end of the moving carriage bracket.

So that's about it. Some pieces of plastic salvaged from the printer case were used to fabricate a simple holder for a fine-point felt pen, which is mounted on the print carriage in place of the original dot-matrix print head. The plastic pieces were simply glued together using epoxy glue, and with a couple of short lengths of 2mm steel wire for bracing. The pen holder has a simple pivot system, with the felt pen itself held in place using sturdy rubber bands (allowing easy pen height adjustment). An old relay is used as a 'pen lift' solenoid, controlled by DANCAD via an interfacing relay; the pen's own weight is used to apply it to the paper when it's not lifted.

The connections to the stepper motors, pen lift solenoid and home sensor on the moving carriage are all made via standard ribbon cable, much of which can again be salvaged from the printer. In each axis it's given a large 'rolling loop' where appropriate, to allow it to accommodate the carriage's movements in either direction...

Needless to say the paper on which the plotter is drawing is simply taped to the base board under the carriage, using small pieces



An overall plan view of Oatley's prototype plotter, which they built to show one simple application of parts from the surplus printers. We hope to give details of the stepper motor translator/driver module (two used here) in a forthcoming article.

of masking tape or similar at the corners.

As noted earlier, for more information on exactly how the various motor translator/driver boards and sensors, etc., are connected to the PC's printer port and controlled using DANCAD, you'll need to refer to the (extensive) documentation in the DANCAD package. As mentioned earlier Oatley Electronics actually recommends that before even *starting* to build a plotter or other project based on the parts from their printers, you have a careful read through the DANCAD documentation. Apart from anything else, this will make clear all of the options there are available, to adapt the ideas for your own needs.

Other possibilities

It turns out that using the parts salvaged from Oatley's printer mechanisms, plus some of their stepper motor translator/driver board kits — and especially, all of the power and flexibility built into the DANCAD software package, it would be quite feasible to build a variety of other projects as an alternative to a plotter (or as a 'next step'). For example you could build a small three-axis engraving machine, a PCB drilling machine, a PC-controlled fretsaw for making jigsaw puzzles, or a baby milling machine or router, of the type used to shape wood or make prototype PC boards.

There are all kinds of possibilities, and Oatley gives you a few worthwhile suggestions and hints in the files on their 'Plans' disk. Again they're really only to 'get you going', though — don't expect step by step instructions.

DANCAD itself seems to be a very powerful and flexible package, with sections devoted to both preparing drawings and plot/machining files (DANCAD 3D), and then using the files to control either a plotter or the motors of a CNC machine (DANPLOT). It runs under DOS, and will work happily on virtually any PC from a '286 upwards — so you can use quite an old 'junk' PC to run things. Another nice feature is that it will import standard HPGL plot files from CAD programs like Protel Easytrax/Autotrax, CorelDraw!, etc.

On the hardware side it can cope with up to four stepper motors and four auxiliary relays (for controlling drill motors, fans, etc.), and can also cope with both home and limit switches on the various axes. In short, it's likely to be able to meet most people's needs for PC control of machinery.

Best of all, of course, DANCAD is shareware — so the price is right. And to make it easier for *EA*'s readers to obtain the package, we've put a copy on our own website for you to download.

Hopefully this article will have given you a good idea of what can be achieved using DANCAD, Oatley's surplus printer mechanisms for parts, and of course their stepper motor translator/driver board kits. In the next article, I'll hopefully be able to give you more information about the last of these: circuit details, how they work, how they're assembled and how they're used.

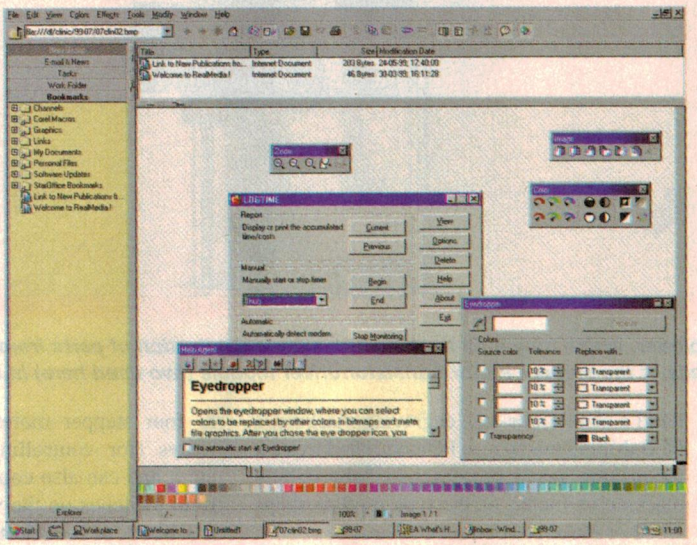
Meantime, though, you might want to download a copy of DANCAD and start reading through its documentation. That's certainly the right place to start, if you don't want to get lost! ❖

Computer Clinic

An Office suite for free, a phone that hangs up on you, more Y2K stuff, modem logging & more...

Star attraction

Having just read your mention in the May issue of EA of Corel WordPerfect Suite, a package that costs almost as much as Microsoft Office, I thought that you might like to know of an office package that is just as good (if not better) than both of them — for free. It's called StarOffice, and it's at http://www.stardivision.com.



It is made by a German company called Star Division, and apart from the fact that parts of the help file have somewhat questionable grammar, there is little to find fault with. StarOffice's feature list is huge — as well as the standard word processor (which includes HTML capability), spreadsheet, database, presentation program and PIM, it includes an e-mail client, a fully-featured Web browser, image editor (with 3D capability), support for several languages, and more. Plus, the whole program is very configurable, is available for nearly every operating system that you can think of, and if you've ever used a word processor before, you probably won't need the help file.

The only problem is the one of download times — at over 50 megabytes, patience is a necessity. But if you can live with that, the result is a great program. (Houran Bosci, by email)

Well, I've had a chance to play with StarOffice over the weekend, and I have to agree it certainly is a full-featured package — some of the best free software I've come across. (except perhaps for Linux...) If I didn't already have Wordperfect and Office, I'd certainly use it on a daily basis.

StarOffice is, however, not for everyone. Star Division have taken the concept of office suite integration further than either Microsoft or Corel have done, in that all of the applications use the same interface, and where possible, the same window.

The whole StarOffice suite takes a little getting used to, as it attempts to combine all of its applications into one interface, so you can 'Do everything in one place', as they put it. There's a sort of replacement Explorer built in that ties file management into the package, so you theoretically never need to leave the application at all. This is a little disconcerting, as it even replaces the Start menu and taskbar with its own custom controls, and the whole suite doesn't quite follow the official Windows style guide. The overall look-and-feel is more like Netscape than anything else, with a large collection of custom window controls and toolbars.

As a result, the whole interface can be somewhat confusing at times — it's surprising to see how much one takes the standard Windows interface for granted. This departure from the Windows standard is quite understandable, though; Staroffice is truly cross-platform, with versions available for Win32, Linux, OS/2 Solaris and even a pure Java implementation. And after all, it *is* free...

Kickoff

I have been having troubles with my modem. After I connect to my ISP (Ozemail) I am disconnected every time between 15 and 17 minutes; never before or after. Using the same equipment from another phone line works fine, and different equipment on the same line suffers the same problem. I am unable to believe that it is the phone line, as the time I am logged on for should vary more than two minutes, however this is the only thing in common between the computers that are kicked off between 15 and 17 minutes. (Graeme Pope, Rankin Park NSW)

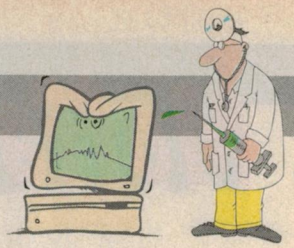
As you say, this can really only be a problem with your line. What this sounds like to me is another device sharing the line, such as an extension phone. Some telephones (especially early-model Touchfone 200s) draw power from the line every 15 minutes or so, in order to charge their internal batteries. The drop in line voltage is enough to seriously degrade the signal quality and eventually cause the modem to give up. Try unplugging any extensions you have, and see if that cures the problem. If it does, you'll probably want to get your phones replaced with newer ones, which are usually much better-behaved. If not, then I suggest you complain loudly to Telstra, and get them to take a look at the line itself.

Y2K update

Thankyou for publishing my question about File Manager and its non-compliant year 2000 status. Since writing to you, I have been poking around the Microsoft Year 2000 website and discovered a Y2K fix for File Manager. The download file for Windows 95 is w95filup.exe. I still prefer to use File Manager rather than Windows Explorer, but then I still love DOS in preference to Windows! (Christine Moore, Seven Hills NSW)

Actually, the file manager patch has now been incorporated into **w95y2k.exe**, the official Microsoft Windows 95 Year 2000 update package. As well as fixing the date display in File Manager, it resolves a number

by Jean-Baptiste Cattley



Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@magna.com.au, or fax or mail it in to us here at EA.

of other issues, including: incorrect date display in the Find Files dialog (in versions 950 and 950a), inability to use the DATE command to set years between 00 and 79, problems with automatic date-format selection in the Regional Settings control panel, log file inaccuracies with the Phone Dialler, leap year problems in the time/date control panel (though this is only a display problem), incorrect handling of the /D: parameter in XCOPY and a rather glorious bug in which some applications will interpret the system time as being one hour earlier than it really is during the first week of April 2001!

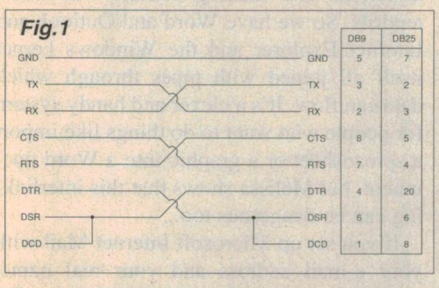
The update is, of course, highly recommended by Microsoft, and you can get it at **http://www.microsoft.com/windows95/downloads/contents/wurecommended/s_wufeatured/win95y2k/default.asp?site=95**. At a little over 2MB, it's certainly worth it, though it does require Internet Explorer 4.02 installed on your system... I'd recommend you install Explorer 4 first from CD (or Explorer 5 for that matter — it's worth it!), or else the Active Setup will try to download it for you at the time, which takes forever.

DCC cable

A while ago I built a 'null modem' lead to connect my two PCs for gaming (via the serial ports). But when I tried to send files from one PC to the other using a direct cable connection program it wouldn't work. So I know now that you can't send files via a null modem setup. In the Jaycar and DSE catalogues I found pre built 'Laplink' cables which are built to send files. But to avoid the hassle of swapping cables I thought I might build a null modem and data lead into one, using a change-over switch.

The data section in the DSE catalogue shows the connections for a null modem and a peripheral cable (i.e. external modem), but not a data transfer cable. I would greatly appreciate it if you could find the connection data for making a data transfer cable as I have had no luck so far. I don't want to give in and buy such a cable — they are expensive! (Michael Gormack, by email)

Fig.1



Right, well, Fig.1 shows the official pinouts for an Interlink cable suitable for Windows' Direct Cable Connection. Unfortunately there are, as you can see, seven lines that have to be swapped around for this type of cable, so a simple switchbox might be a little too complex to be really practical. All in all, you'd probably be better off making up two separate cables, then using a cheap printer switch box to switch between them.

Speed hump

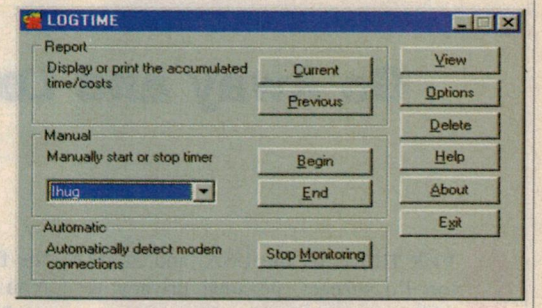
I came across an interesting problem myself this month, when I put an AMD K6-2/350 into my main Windows 95 work box as an upgrade from my old K6-2/300. (Not much of a jump, admittedly, but the old CPU went to a good home...) After installing it, I powered up and watched the system die horribly every time with an IOS error on starting Windows 95.

After triple-checking the clock speed and multiplier settings, I did some digging, and found that Win95 OSR2 actually has a timing bug that can't handle K6 CPUs faster than 300MHz. After a quick trip to the microsoft web site, I found the patch for this nasty little bug. If you're considering moving to a fast K6 (which you should — they're nice and fast, and half the price of Intel CPUs) you should take a look at **http://support.microsoft.com/support/kb/articles/q192/8/41.asp** before upgrading.

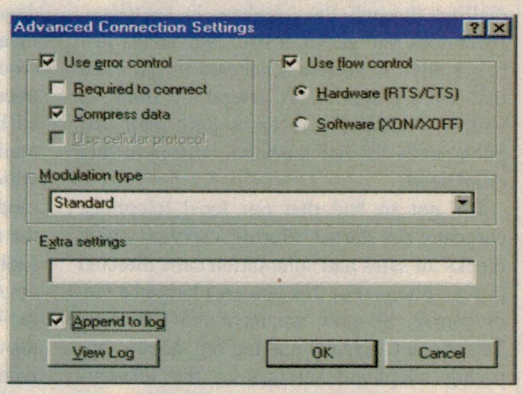
Log on

I've looked through your project index for something that would time how long I've been on the Internet, but I couldn't find anything. Have you done such a project? My ISP charges $4.00 an hour for my Internet connection, and I'd like some way of keeping track of the bill. I tried to make my own time logging program using a batch file, but I didn't get very far. I can save the time when I run the batch file, but I can't work out how to then make it dial my ISP. Can you help? (Eric Schulz, by email)

To answer your initial question, no, we haven't done such a timer for a number of reasons. D-I-Y circuits that connect to the phone line are severely frowned upon by the telecom authorities, not to mention the fact that such a project would be rather expensive, with the need for battery-backed RAM, and some form of numeric display.



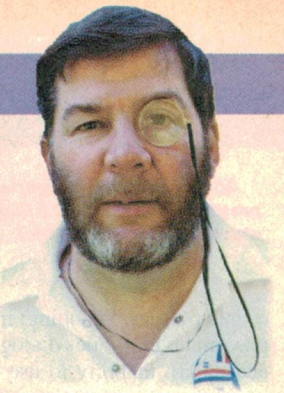
Looking at the alternative software solution, your batch file could use the START command to open a website, letting your browser dial for you ('START http://www.electronicsaustralia.com.au' for example), but there's no easy way for the program to detect the connection's being closed, so you'd have to run a second batch file manually to log the stop time. Also the DOS batch language can't perform any maths functions, so you couldn't easily calculate the elapsed time. All in all, this is too much like hard work.



One thing you *could* do would be to set your DUN connection to append all entries to the log file it creates, instead of simply restarting each time. To do this, right click the connection in the Dial-up Networking folder, and select Properties|Configure|Connection|Advanced->Append to log. This logs all modem activity to c:\windows\modemlog.txt, and it wouldn't take much to import the log into a database program and extract the relevant information from there. This is still a long way round a short corner, however...

By far the easiest way is to go to **http://web.singnet.com.sg/~cslheng/logtime/info.html** and download Logtime, a handy little utility that sits in the system tray and automatically detects and logs net connections. It generates detailed reports, and can be customised for just about any ISP charging scheme there is. It's small, it works, and (of course) it's free. Enjoy! ❖

Moffat's Madhouse



Go Away and Leave Me Alone!

OVER HERE IN the USA, and in Oz too I'd suspect, personal privacy is taking a real beating. Here we get nightly phone calls, always at dinner time, trying to talk us into buying new siding or a roof for the house, or yet another long-distance telephone service.

They always ask for me by name, usually pronounced "Mister Mow-fat". That means they're getting me from a list, instead of just dialling through the numbers in sequence. How does one get on a list? Nowadays just being alive is all that's necessary, but even that isn't essential. A friend of mine, a widow, continually receives junk mail and phone calls for her husband, who is in fact quite dead.

It's got so bad that our local telephone company has started offering a service which blocks all sales and solicitation calls directed to your phone. For this you are charged a fee, of course. So now we have the US West Telephone Company making big money supplying telephone services to the telemarketers, and further big bucks blocking the calls the telemarketers are trying to make. Talk about burning the candle at both ends...

Mail, too, is flooded with solicitation letters, often addressed to me at my business name, Technical and Media Services. I NEVER send any outgoing mail under this name; my communication is always by e-mail or telephone. So the direct marketers must be getting my business name from my e-mail, or possibly my Web page.

E-mail privacy is being threatened more and more every day. You might have heard of the Melissa virus that stormed its way throughout the world in late March. That one plopped a message into your in-box, headed 'Important Message from John Smith'. Within the body of the message was 'Here is that document you asked for... don't show anyone else ;-)' Beneath that was an attachment, a Microsoft Word file called 'list.doc'.

When you clicked on the filename you were shown a list of porn sites, but while you were deciding which one to go to first, Word was paying a visit to your Outlook e-mail handler, forwarding the Melissa message to the first fifty names in your address book. You can imagine how far and fast this thing could multiply; in fact Melissa became known as the digital Typhoid Mary. One company received 32,000 messages in less than an hour. More than 100,000 computers were affected worldwide.

The fellow who perpetrated this dastardly deed was quickly nailed and now he rests in the slammer, awaiting trial. He was tracked down by several paths, each one a serious invasion of privacy for anyone who's not a crook. One story has it that the villain was traced back to his telephone number. He posted his handiwork via an America Online e-mail account, and AOL keeps records of which phone numbers dial into which modems at what times. So a quick search of the telephone records produced a supposedly foolproof identification of the Melissa e-mailer. Another account says Melissa was posted to AOL via an intermediate internet service provider in New Jersey, and his connection records were able to deliver the goods.

The most insidious path involves a Microsoft feature called the 'GUID', or Global Unique Identification. This is a serial number that gets embedded in every Windows computer. The number is in turn copied into every piece of work done on your computer, at least with Microsoft software. So if you e-mail a Microsoft Word document to someone else, your computer's GUID goes right along with it.

One clever investigator posted the GUID from the Melissa document onto the internet, asking people to compare it with other Word documents they might have received. An answer came back from Sweden: a researcher there had documents from a fellow with the username 'VirodinES'. The GUID on these documents was identical with the GUID on Melissa. So VirodinES, alias David Smith, was busted a second time, a backup for the earlier telephone number method. He now faces 40 years in jail.

How do you get your GUID, that electronic tattoo on your computer's forehead? Since Windows CD-roms are mass produced, every copy of a particular Windows version is identical. So the GUID number has to get there some other way. It's likely this could come about when you Register Windows online. But I haven't registered my Windows (I never register anything if I can avoid it), so my GUID had to get there some other way, perhaps during a visit to a Microsoft site on the internet.

It's interesting to look through your computer's registry, searching for 'GUID'. Mine popped up under Microsoft software, and it was accompanied by another registry key stating that my 'Primary Provider' was 'The Microsoft Network'. I have never been on the Microsoft Network, and I've booted the come-on software clean out of my computer to prevent any accidental signups. So where did it get the idea I was on the Microsoft Network? I suspect that registry key landed there at the same time the GUID arrived.

It appears that Microsoft isn't the only organization planting GUID's in my computer. The search revealed a couple of other instances of 'GUID', associated with some non-Microsoft software I use. I suspect I got hit by that big rubber stamp when I visited their web sites. It's kinda scary to think that somebody may be able to modify the contents of the registry, the most important files in your computer, while sitting in an office on the other side of the world.

The Melissa affair suggests that Microsoft's top-line software may be getting too clever for its own good. Melissa could only be propagated by Microsoft Word's ability to reach out and take control of the Microsoft Outlook e-mail system. In the case of Windows 98 especially, all this stuff is interlinked with tendrils reaching out in all directions and making contact with other tendrils. So we have Word and Outlook and Internet Explorer and the Windows kernel itself all joined with pipes through which data can flow. It's a clever and handy system for people who want to do things like import a spreadsheet or a graphic into a Word document, but Melissa shows that this interlinking can be dangerous too...

If you set up Microsoft Internet Mail with your e-mail address and your real name,

Internet Explorer and everything else has access to this information too. My own computers were immune to Melissa primarily because there is no link between my Eudora e-mail and Microsoft Word. Eudora stores all its information in local .INF (information) files with its own directory, rather than the registry which is available to any application in the computer.

It appears that this intensive linking really began with the birth of Microsoft Office, which is a suite of several programs all designed to work together. My version of Microsoft Word is pre-Office, so it's not so closely tied to any other programs. The Outlook e-mail shell and the Internet Mail application bit the dust during a fresh install of Windows 95. So, hopefully, there's nothing in the computer that can join forces with something else and do dirty deeds behind my back.

Free — at a price

As you know, the price of computers has been dropping steadily, and now in the USA the price of some computers has hit zero, Yes, FREE. During a big sales promotion, basic PC's were offered for free, but there was a catch. In return for your free PC, you had to hand over detailed personal information to make you a valuable "demographic" for other sales pitches. An application form for your free computer demanded not only your name and address, but your age, annual income, and shopping habits.

Armed with this information, the promoters of the free PC knew which adverts you were most likely to respond to. Something like 40% of the computer's screen was turned into an advertising billboard. Half the free PC's hard drive was set aside for advertising content, and whenever you logged onto the internet it was filled with ads especially tailored for you. So the advertising could be displayed on your screen continuously, even when the computer was not online.

There was a limited number of PC's available under this scheme, and every single one was snapped up on the first day of the promotion. I found this very surprising indeed. I certainly wouldn't have sold *my* soul to the marketing industry in return for a free computer, especially when you can now buy a traditional machine without the advertising for under $300. But I guess the American psyche has learned to expect things to come with strings attached, and to welcome it rather than fear it.

If you install Windows the way you're supposed to, some of your personal details are stored away in the registry, ready to be sucked out by a computer owned by a marketing firm. This comes about because Windows likes to think it's connected to a network, even if it's sitting alone in your living room. When you first set up for an internet connection, a good part of the job is done in the Network area of Control Panel, and a 'Network Neighborhood' icon is placed on your desktop whether you need it or not.

As part of the network setup, you are asked to provide a domain name and a host name. Your domain name is supposed to be that of your internet service provider (such as 'isp.com.au') and the host name should be your ISP username (such as 'user'). When the computer is asked to identify itself on the network (often by a marketing organization) it joins the two entries and spits back 'user.isp.com.au'. All the marketer needs to do is replace the first dot with an @ sign and he has your e-mail address — user@isp.com.au — ready for continuous doses of spam junk mail.

It's kinda scary to think that somebody may be able to modify the contents of the registry, the most important files in your computer, while sitting in an office on the other side of the world

A network also expects the computer itself to have a name, a workgroup name, and a record of the kind of computer it is. Due to a Windows bug, especially in older versions, you must supply this information or Windows will refuse to store your internet password.

It is a fortunate state of affairs that the information you supply doesn't necessarily need to be correct, so you can thwart many marketing efforts with some creative lying. You can give anything you want for the host and domain names. I've got a combination of fake names that has served me well for a long time. I won't mention them here because that would blow my cover. But you can make up your own — how about something like 'hacker' and 'jail.gov.au'. Or you can leave the settings blank.

One place I've found the host/domain combination is in the header of every Eudora e-mail message I send. It's apparently supplied when the computer logs onto the mail server which responds with "helo: hacker.jail.gov.au". If you've left the host/domain blank, as I do when there are multiple ISP accounts on the one computer, the helo message gets the computer name instead. Of course I've faked this one too. My computer is known as 'Loud_Belch' in recognition of the sound it makes after successfully downloading a large file. 'Loud_Belch' also appears when I make contact with another computer over an infrared link.

After spoofing your computer with a creative collection of fake names, you can use the Regedit program to search for them in the registry. You'll most likely see them pop up in several places. Remember, they could have been your REAL name, falling into the clutches of every mass marketer in the land.

There is one other place your real name may appear: under Control Panel, open the System icon and you'll see the information you entered the first time you ran Windows: Your name, possibly an organization name, and the registration number you had to enter from the front cover of your Windows manual. It might be good to change your real name here too. You'll find it in the registry under HKEY_LOCAL_MACHINE/Software/Microsoft/Windows/ CurrentVersion. Here you will see the keys 'RegisteredOwner', 'RegisteredOrgazation' and the Windows registration number.

You can edit each key to anything you want. I have given my computer a rather audacious owner name, straight from the British aristocracy. If anyone sees that name come out of my computer they are certain to realize nobody could seriously have a name like that. So hopefully they'll give up and leave me alone.

As for the GUID, that still presents a challenge to get rid of. I wouldn't be at all surprised if Windows totally refused to run if deprived of its GUID. There are many registry entries related to GUID, many of them in hexadecimal, so I'm viewing any potential hacking attempts with caution. Maybe some clever reader could take on this project and gain eternal gratitude from people who worry about the continuous erosion of their privacy. ❖

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Electronics Australia **is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here are some interesting items from past issues:**

50 years ago

July 1949

Novel Design in New Microwave Triode: Because of gain and bandwidth limitations, Klystron tubes are not ideal for extensive microwave links. A new planar microwave triode developed by Bell Laboratories operates successfully at 4000Mc/s.

The cathode oxide coating of the new BTL 1533 tube is 1/2 mil thick, the grid-cathode spacing is 0.6 mil, the grid wires are 1/3 mil in diameter, wound at 1000 turns per inch, and the grid-anode spacing is 10 mils. The nickel cathode core is mounted in a ring of low-loss ceramic, in such a manner that the nickel and ceramic surfaces may be precision ground flat and co-planar.

At a plate current of 25mA, the transconductance is about 2000, or one fifth of the theoretical upper limit. One stage of class A amplification using simple resonant cavities and coupling windows will provide 7 - 10dB gain at 4000Mc/s with a 3dB down bandwidth of 80 - 100Mc/s.

Surgery by Television: Guy's Hospital, London, has the world's first television-equipped operating theatre permanently installed. A special television camera is incorporated in the Scialytic shadow-proof light over the operating table.

25 years ago

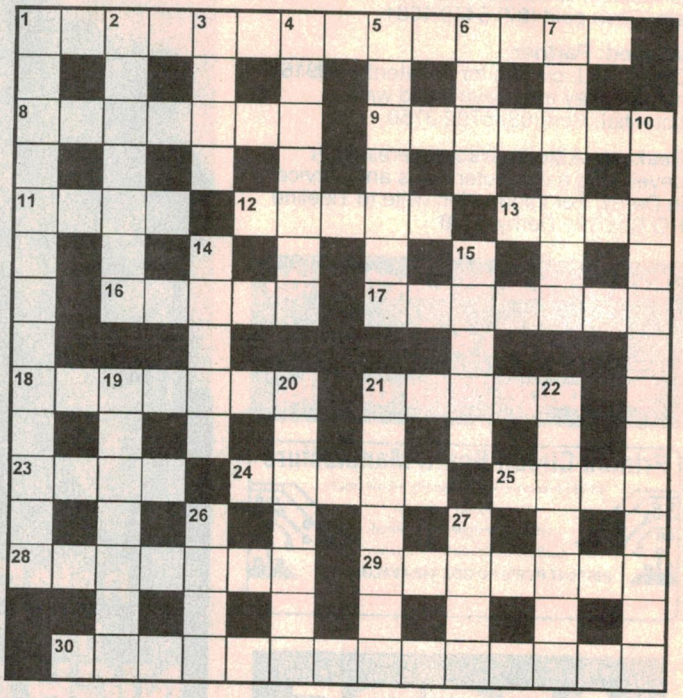
July 1974

Portable Radar Locates Buried Objects: A portable radar system, capable of 'looking down' through concrete and several feet of soil, has been developed by the Calspan Corporation of Buffalo, New York, in association with the Mine Detection Division of the US Army Mobility Equipment Research & Development Centre at Fort Belvoir, Virginia. The new system has a number of varied uses, from detecting buried objects to monitoring the subsurface conditions of highways.

Detection is made possible by the fact that every subsurface discontinuity will exhibit a change in electrical properties. As the radar penetrates the soil, part of its energy is reflected back to the antenna. The characteristics of the returned signal relate to the nature of the surface that reflected it.

Local Diode Maker Expands Production: In view of the recent closures and winding-down of local semiconductor manufacturing plants, it's heartening to hear that one plant is actually expanding operations: Centre Industries, the Sydney based facility operated by the Spastic Centre. The plant has been making General Electric A-14 glass passivated silicon diodes since mid-1972, but is now producing the more husky A-15 diode series as well. Acceptance of the devices locally has been high. ❖

Crossword



Across

1 Increase of emission due to electric field. (8,6)
8 Measure of energy unavailable for work. (7)
9 Grounded. (7)
11 Satellite balloon of the 1960s. (4)
12 Supporting arm. (5)
13 Reduce image extent. (4)
16 Fluorescent red dye. (5)
17 Charm (7)
18 Concerned with electrical induction. (7)
21 Supergiant in Orion. (5)
23 Produce surface impression. (4)
24 Precise instant in satellite's orbit. (5)
25 Significant fraction of a wavelength. (4)
28 Divide into three parts. (7)
29 Potential difference. (7)
30 Expulsion of magnetic field from a superconductor. (8,6)

Down

1 Current production between conductors at different temperatures. (7,6)
2 Camera contact. (3,4)
3 Sound of horn. (4)
4 Inert atmospheric gas. (7)
5 Carry out instructions of a program. (7)
6 Discharge glow, St Elmo's .... (4)
7 Early radio-wave detector, attributed to Branley. (7)
10 Observed frequency shift. (7,6)
14 Secondary recording. (1,4)
15 Functional unit of an electronic system. (5)
19 Accept and process a signal. (7)
20 Rotating part of tape recorder. (7)
21 Extract valuable material from scrap. (7)
22 Loss of current. (7)
26 Focussing device. (4)
27 Sign in musical notation. (4)

❖

June's solution:

D	O	W	N	L	O	A	D		U	P	T	A	K	E
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Electronics Australia's

Professional Electronics

Eurovox to use Magellan mobile satnav technology

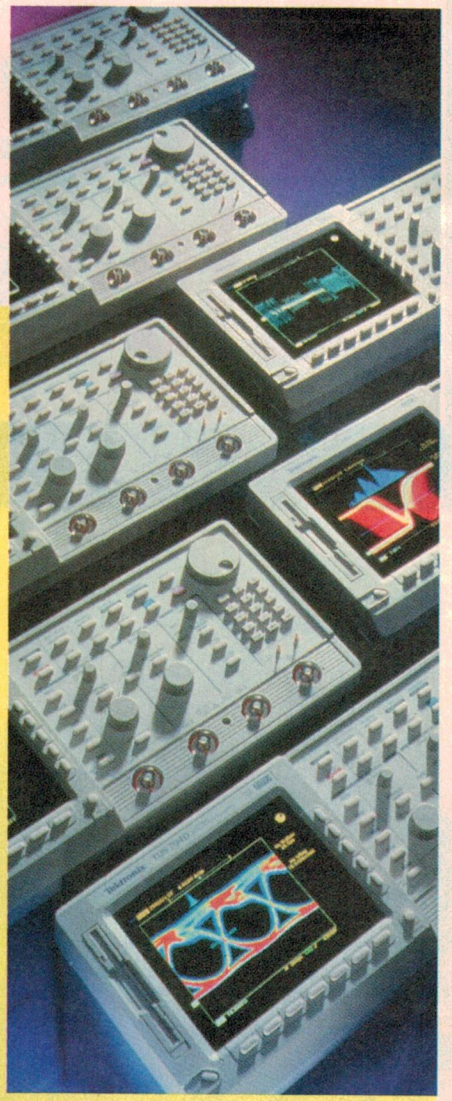
Lucent claims fastest single laser optical transmission system: 40 gigabits/second!

Interesting components for robotics: Muscle Wires

VLSI Technology agrees to sweetened buyout offer by Philips: US$1.2 billion

Upgrading the radio ionosonde antenna system on Macquarie Island: apart from tricky weather conditions, some of the original inhabitants objected to the intrusion...

highlights News



Awards for Tek's DPO technology

THE TECHNOLOGY developed by Tektronix Inc. for its latest generation of digital phosphor oscilloscopes (DPOs) has been selected from a field of hundreds of candidates as the winner in the Test and Measurement category in the EDN 1998 Innovation of the Year Awards Competition. This exclusive awards program, sponsored by *EDN Magazine*, is dedicated to honouring outstanding engineering products in the electronics industry. The DPO, announced on June 15, 1998, is a class of instruments that provides the performance necessary for analyzing dynamic complex electronic signals using three dimensions of information in real-time.

"We are pleased that EDN, the premier design magazine of the electronics industry, and its readership, recognize and validate DPO as a new class of oscilloscope critical to enabling design engineers to achieve their next generation design goals", said Balaji Krishnamurthy, VP of the Design, Service and Test Business Unit for Tektronix' Measurement Business Division.

Tek's DPO technology has also won many other awards. *New Media* magazine of Korea awarded the DPO technology its Product of the Year prize in the factory automation category. *Elektronik Revue*, Germany, presented the DPO with the Product Innovation 1998 award, while *Electronique International Hedbo* of France named DPO Technology of the Year in the measurement category. In the United States, the DPO has received honours from *Electronic Products Magazine* (Product of the Year); *Microwaves & RF Magazine* (Top Products of 1998); and *Test & Measurement World* magazine (honourable mention for the 1998 Best-In-Test awards).

"Receiving industry recognition from major international publications and their readers confirms the strength and importance of our DPO technology in the electronics design engineering community", said Vince Ganley, VP of Tektronix' Asia Pacific Operations.

Eurovox to use Magellan satnav technology

EUROVOX, the leading Australian supplier of automotive audio entertainment systems to Australia's auto manufacturers, has signed an agreement with California-based Magellan Corp. (a satellite navigation and communications subsidiary of Orbital Sciences Corporation) to design, develop and manufacture advanced, satellite-aided, in-vehicle navigation systems for markets in Australia and New Zealand.

Magellan will license its vehicle navigation technology to Eurovox. Under a separate technical support and services agreement, Eurovox will develop navigation equipment for original equipment manufacturers (OEMs) and original equipment importers (OIMs), as well as commercial and consumer applications. Further details of the agreement were not released.

The products to be developed will use Magellan's latest turn-by-turn vehicle navigation and information technology, incorporating satellite positioning, patented inertial navigation capability and digital map matching, to provide voice- and visually-prompted driving instructions. The same technology is being used in the recently announced Magellan-Hertz Corporation joint venture to expand the Hertz NeverLost vehicle navigation service, and in Magellan's own 750NAV consumer aftermarket product, according to Magellan President and CEO John Huyett.

"This agreement between Eurovox and Magellan is a fantastic opportunity for both companies. The resources and technology that have placed both Eurovox and Magellan at the head of their respective markets will now provide a platform for future developments that will shape in-vehicle information systems into the 21st Century", said Eurovox MD Paul Miller.

Since 1975, Eurovox has grown to become the largest car audio distributor in Australia in the OEM, OEI and aftermarket segments. The company offers motor vehicle manufacturers and importers a total car audio design, development and manufacturing facility, with full QS9000 worldwide automotive standard accreditation.

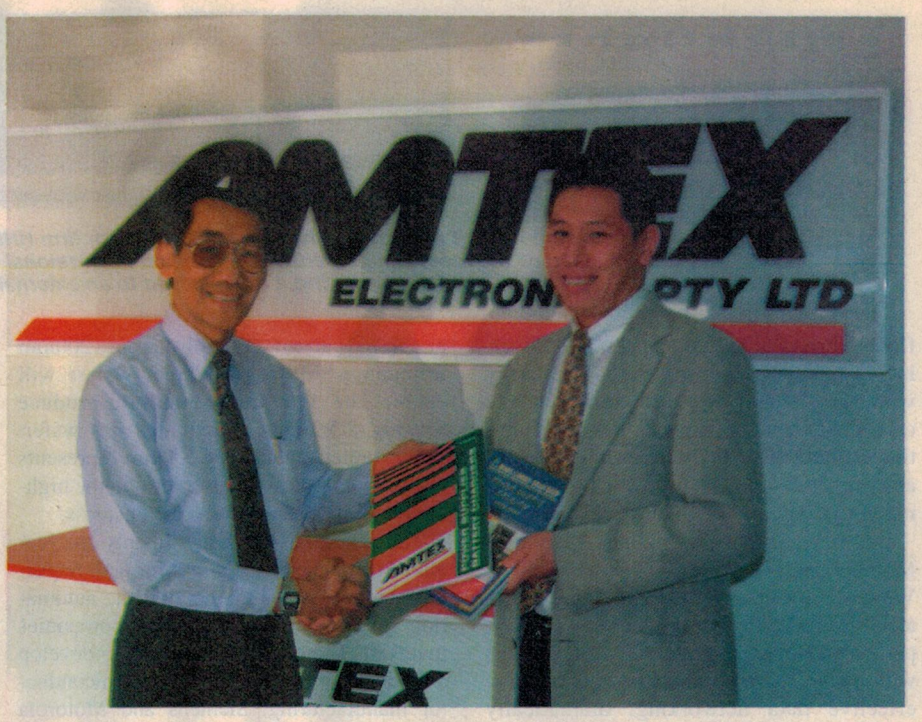
Eurovox-built products can be found in vehicles from manufacturers such as Audi, BMW, GMH, Land Rover, Mercedes-Benz, Mitsubishi, Nissan, Peugeot, Scania, Volkswagen and Volvo.

Amtex now main Nemic-Lambda distrib

SYDNEY HEADQUARTERED power supply specialist Amtex Electronics has become the major local distributor for the power supply products of Nemic-Lambda, recognised internationally for their high quality and reliability. Nemic-Lambda has its head office in Tokyo and has manufacturing facilities in Japan, China, Vietnam and Israel — but is actually owned by UK giant BTR Siebe PLC. Other power supply makers in the same group include Lambda (USA), Coutant (UK) and Weir (UK).

The company chose Amtex Electronics because of their 21 years of specialisation in power supplies, and also their reputation for technical support. Amtex will carry a substantial stock of this new range, which includes AC-DC power supplies, DC/DC converters and power modules, rack systems and customised specials, noise filters and lightning protection devices.

Our picture shows Amtex general manager Jim Kuswadi (L) with Nemic-Lambda's technical marketing manager in Australia, Mr T. Shimizu. For more information contact Amtex Electronics, 2A Angas Street, Meadowbank 2114.



Philips T&M gone, Fluke Australia here

THE TEST & MEASUREMENT division of Philips Electronics ceased trading in Australia on April 30, while Fluke Australia Pty Ltd commenced trading on May 3. The new company is located at Unit 26, 7 Anella Avenue, Castle Hill 2154. Phone (02) 8850 3333 or fax (02) 8850 3300.

Box Hill Institute links with CQ Uni

STUDENTS AT MELBOURNE'S Box Hill Institute will have further education opportunities available to them following the recent signing of a Joint Activity Agreement with Central Queensland University. Under the agreement, signed at the BHI's Nelson Road Campus, students will be able to capitalise on a range of articulation arrangements in the areas of Engineering, Information Technology and Electronics. This means Institute students can in some cases gain credit for up to two thirds of a degree, following successful completion of a Diploma.

For instance students enrolling in the Institute's Associate Diploma of Engineering are guaranteed a place in the Bachelor of Engineering Technology at Central Queensland University's Melbourne Campus. Successful completion of the Associate Diploma gives two years credit into the University's program as well as three qualifications along the way. These are the Advanced Certificate in Engineering; the Associate Diploma of Engineering and the Bachelor of Engineering Technology. Eventually the organisations hope to further integrate TAFE and University studies so that students can gain a dual qualification.

Mr Andrew Jackson, CEO of Box Hill Institute and Professor Lauchlan Chipman, Vice Chancellor and President of Central Queensland University believe that the agreement increases students' opportunities to study across both sectors of education and therefore gain both practical skills and theoretical knowledge. "This agreement will give students the best of both educational worlds", said Mr Jackson.

Professor Chipman said that Central Queensland University was "committed to strengthening its reputation as the university where students come first".

Smallest ever CMOS image sensor

Toshiba Corporation claims to have developed the world's smallest and lightest complementary metal oxide semiconductor (CMOS) image sensor with an integral lens. At only 1/7" (10 x 10 x 6mm), the sensor is fully compatible with the Common Intermediate Format (CIF) for videoconferencing. Its power consumption is also significantly lower than that of any comparable charge-coupled device (CCD).

Available in both colour (TCM5023LU) and black and white (TCM5020LU) versions, the sensor's small size and high level of performance is expected to spur wider demand for PCs with built in cameras and portable videophones. It's claimed as the ideal image-input device for a new generation of small, personal multimedia tools. The integration of the lens into the sensor eliminates any need for assembly of optical components when building the device into cameras or PDAs, promoting reduced manufacturing costs and shorter development times.

Use of CMOS process technology cuts power demands made on battery-powered personal equipment. Operation requires only a 2.8V single power supply, and consumption is 15mW. This is only approximately 1/5 that of an equivalent CCD camera system, even with its dedicated digital-signal processing chip (DSP), which integrates key peripheral circuitry, including correlated double sampling noise reduction, an automatic gain controller to stabilize output levels, and a 10-bit A/D converter.

In performance, the sensor is fully CIF-compatible, meeting the format's specification for a 352-horizontal by 288-vertical pixel frame with an effective pixel count of approximately 100,000 pixels.

World's fastest single-laser optical transmission system

LUCENT TECHNOLOGIES has announced that MCI WorldCom will be the first carrier to test its new WaveStar 40G Express — claimed as the world's fastest single-laser optical transmission system. It will be the

At the recent Audio Engineering Show in Munich, British firm HHB Communications unveiled its new CDR850 PLUS, claimed as the most comprehensively equipped Professional CD Recorder/Player yet developed. Features include a Word Clock input, allowing it to be locked to an external master clock during replay. (More info from steve.angel@hhb.co.uk)

first commercial system capable of delivering 40 gigabits per second (Gb/s) of capacity with a single laser over a single wavelength on a single fibre-optic cable, making it four times faster than today's commercially available single-laser systems (which support a maximum capacity of 10Gb/s).

Lucent's 40Gb/s Time Division Multiplexing (TDM) technology enables the WaveStar 40G Express to transmit the equivalent of 500,000 simultaneous phone calls per second over a single wavelength. This will enable service providers to offer cost-effective data networking, dramatically faster Internet access and other advanced telecommunications services.

A leader in the deployment of very-high-capacity fibre-optic transmission systems, MCI WorldCom recently hosted early lab system trials of Lucent's 40Gb/s TDM technology in its Richardson, Texas, network technology laboratories. The trials produced carrier-quality transmission and focused on the performance of this high-speed technology over standard fibre and through optical switching systems at distances up to 100km. Lucent will deliver its WaveStar 40G Express to MCI WorldCom for commercial testing by the fourth calendar quarter of 1999.

Developed by Bell Labs, the WaveStar 40G Express is being designed for multi-wavelength applications with the WaveStar OLS 400G — Lucent's 80-channel DWDM system — to provide a capacity of more than a terabit per second (one trillion bits) on a single fibre strand.

First working chips on 300mm wafers

SEMICONDUCTOR300, the joint venture of Siemens Semiconductors and Motorola's Semiconductor Products Sector, has announced what are claimed as the world's first fully functional IC chips processed entirely on 300mm equipment. The complex, state-of-the-art 64Mb DRAM chips were produced on the partner companies' development line at Dresden, Germany.

Representing next-generation manufacturing technology for the semiconductor industry, success on 300mm wafers will allow the companies to reduce overall production cost per chip by about 30%, compared to current state-of-the art 200mm technology. Moving to larger wafers will enable the two companies to produce roughly 2.5 times more chips per wafer. Early implementation of 300mm represents one of the major success criteria in the highly competitive semiconductor business.

This milestone was achieved only one year after Semiconductor300 was formed, requiring standardisation of equipment, automation and material among the companies involved. The challenge ahead is to develop a totally new concept of future semiconductor manufacturing. Siemens and Motorola expect the overall development work to be finalised in the year 2001.

Semiconductor300 represents a total R&D expenditure of more than one billion DM (US$595 million). In addition to Siemens and Motorola, the project is supported by the German Federal Ministry of Education, Science, Research and Technology (BMBF) with DM 187 million (US$111 million) and the State of Saxony with about DM 120 million (US$71 million).

Silicon Valley firm Inviso's new Personal Information Display is based on OptiScape II, a single-chip display device only 25 x 25 x 12.5mm which provides 800 x 600 pixels and full colour — and when viewed from 65mm away, appears like a full sized 19" monitor. You'll find more details at http://www.inviso.com.

DTV begins in the main US markets

DIGITAL TELEVISION broadcasting officially began in the USA on May 1, when commercial stations in the country's top 10 market areas were required to begin DTV broadcasting as a requirement by the Federal Communications Commission (FCC). This means that some 30% of US households now have the ability to receive DTV broadcasts.

To date more than 20 manufacturers have introduced a variety of digital products, including DTV receivers, set-top boxes and DTV capable displays. By the end of March, more than 25,000 DTVs and set-top boxes had been sold, and retailers report continuing high demand.

Initial prices for digital HDTV are around US$6000 - 7000, with set-top converters priced at around US$1700. HDTV display start at around US$2800. The price of set-top converters is expected to fall to around US$700 before the end of the year.

Analog (NTSC) free-to-air broadcasting is currently planned to cease in the US by 2006, although few in the industry expect that DTV penetration will allow this date to be achieved. Federal legislation approved in 1997 allows for a continuation of analog broadcasting in markets where there is less than 85% penetration of digital sets.

Sarnoff claims LCD breakthrough

SARNOFF LABS, formerly the famous RCA Laboratories and the original developers of liquid-crystal display (LCD) technology, has announced what is claimed as a breakthrough expected to allow the current manufacturing cost of active-matrix LCD panels to be reduced by over 30%.

The improved technology is called Self-scanned Amorphous Silicon Display (SASID), and essentially reduces the number of connections needed for scanning the LCD panel via driver electronics. Instead of the usual 3000-odd connections needed for a typical SVGA (800 x 600 pixels) display, for example, SASID reduces the connections to approximately 200 — a reduction of about 95%.

In conjunction with Thomson Multimedia, Sarnoff is licensing the new technology to display manufacturers in Europe and Taiwan.❖

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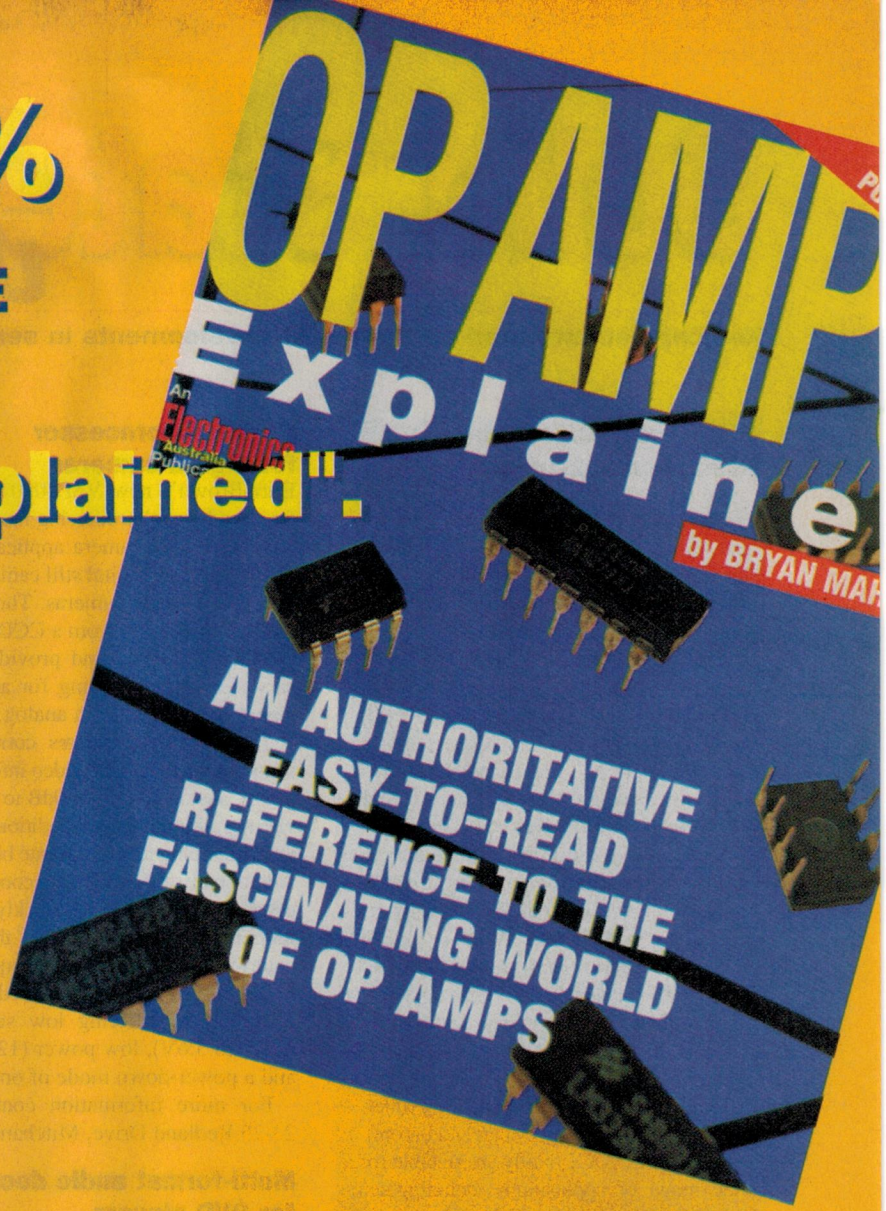

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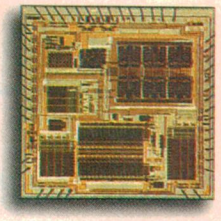
Solid State Update



Keeping you informed on the latest developments in semiconductor technology

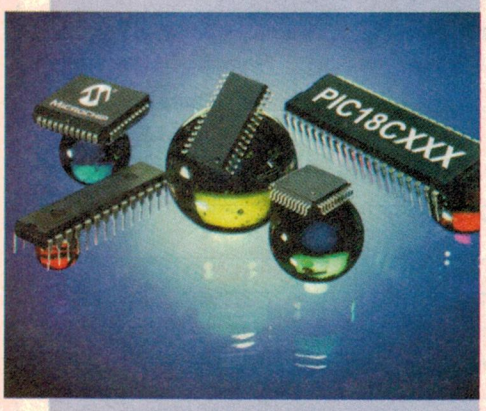
High-performance 8-bit RISC microcontrollers

Microchip Technology have released their new range of PIC18CXXX 8-bit high-performance RISC microcontrollers, which are upwardly compatible with their mid-range PIC12C6XX and PIC16CXXX devices, plus their high-end PIC17CXX range. These new one-time-programmable (OTP) controllers feature up to two million bytes of program memory address space, a C compiler friendly development environment (linear memory map), and 10 MIPS performance at a 40MHz clock rate.

Available in a range of OTP memory and user RAM space configurations, all versions contain high precision analogue peripherals such as 5- to 8-channel 10-bit (+/-1 LSB) analog-to-digital converters, plus a programmable low-voltage reset and brownout detector. The microcontrollers also feature 23-24 I/O pins, a range of communication protocols, two 10-bit PWM capability, one 8-bit and three 16-bit timers, a watchdog timer, a wide 2.5-5.5 operating voltage, and more.

The PIC12CXXX family are suitable for a wide range of applications including anti-lock braking systems, vehicle active suspension, fuel injection and pump systems, manufacturing equipment, instrumentation and monitoring, data acquisition, power conditioning, thermostat and environmental monitoring, telecommunications and consumer audio/video.

For more information see Microchip's website at **www.microchip.com**, or contact Microchip Technology Inc, 2355 West Chandler Blvd, Chandler, Arizona 85224-6199.



Front-end processor for digital cameras

Burr-Brown's new VSP2080 is a complete front-end signal processing integrated circuit (IC) for digital camera applications such as video cameras, digital still cameras, PC cameras and security cameras. The device takes the output directly from a CCD (charge-coupled device) array and provides the necessary signal conditioning for accurate video signal conversion from analog to digital.

The VSP2080 features correlated double sampling to extract the video information from pixels, analog control of 0dB to 34dB gain for varying illumination conditions, and black level clamping for an accurate black reference. Additionally, the stable gain control is linear in dB and the black level is quickly restored after illumination changes. All of these attributes contribute to enhanced picture quality.

The VSP2080 is optimized for portable operation by offering low supply voltage (2.7V to 3.6V), low power (120mW at 3V), and a power-down mode of only 10mW.

For more information contact Kenelec, 23-25 Redland Drive, Mitcham 3132.

Multi-format audio decoder for DVD players

Making use of its experience in high-end audio, Cirrus Logic has developed a universal DVD audio decoder IC that provides eight output channels of high-quality sound for 'universal' DVD players — those equipped to play a wide range of movie and audio discs.

The new CS49300 is the only chip presently available that supports the recently-introduced Meridian Loss Packing (MLP) audio format, and is reported to be the only single-chip multi-standard decoder offering both DTS capability plus the highest quality Dolby Digital standard, Dolby A. The chip also supports the MP3 music format, MPEG audio decoding, and packet stream audio-visual synchronisation technology for lip synching.

To ensure the highest possible fidelity, the 'Crystal' brand CS49300 is capable of sample rates of up to 192kHz and has a full 24-bit output. Thanks to its eight output channels the chip can support all of the common output configurations, including the 5.1, 6.1 and 7.1 standards.

With an eye on the future, Cirrus Logic have incorporated significantly more on-board

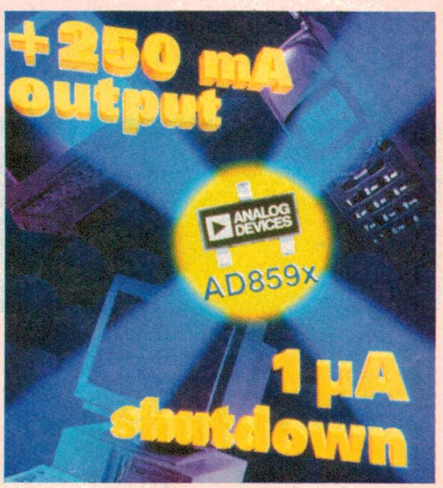
memory than their competitors, which eliminates the need for costly external memory and allows space for new firmware standards. More memory also enables all-channel delays for DTS, AC-3 and THX, making the system more effective for room synchronisation.

For more information see Cirrus Logic's website at **www.cirrus.com**, or contact Cirrus Logic Inc, 3100 West Warren Avenue, Fremont, California 94538.

Op-amps offer high output, low current

Analog Devices has released the AD859x family of low-cost, single-supply operational amplifiers, which are claimed to offer the highest output (+/-250mA) and lowest shutdown (1uA) currents. This output current is more than three times that of the nearest competitive product, while the shutdown current is less than half.

The new single AD8591, dual AD8592 and quad AD8594 are fully specified for operation in 2.7V to 5V systems. Rail-to-rail capabilities maximize the input- and output-



signal range for accurate signal transmission in modem-data and telephony-signal applications. Even with a 5V/us slew rate and 3MHz gain-bandwidth product, the parts are stable with virtually any capacitive load, easily driving hundreds of nanofarads with no fear of oscillation.

These amplifiers are particularly well suited for portable audio applications such as cellphone handsets and headsets, PC audio, sound ports and sound cards. The high output current is also great for line driving applications, such as modems, PBX, line cards, computer telephony, set-top boxes and portable instruments.

For data acquisition system manufacturers looking for low-cost solutions, an inexpensive sample-and-hold circuit can be constructed with a single external capacitor by taking advantage of the high impedance output in shutdown mode.

For more information contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

Fast, low power 8 channel 12-Bit ADC

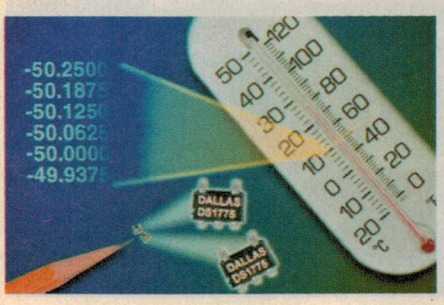
Burr-Brown's new ADS7852 is an eight channel, 12-bit analog-to-digital converter (ADC) featuring high speed and low power in a small package — 500kHz sampling rate and only 12mW power dissipation. Its features are claimed ideal for multi-channel applications where low power and small size are critical, such as medical instrumentation, high-speed data acquisition and laboratory equipment systems.

The ADS7852 comes complete with sample and hold, an internal 2.5V reference, single 5V supply, and a full 12-bit parallel output interface. It features both a nap mode and a sleep mode, further reducing the power consumption to 2mW. The input voltage range is 0V to 5V using the internal reference, or 0V to twice an external reference voltage (reference voltage can be overdriven by an external voltage).

For more information contact Kenelec, 23-25 Redland Drive, Mitcham 3132.

Temperature sensor in an SOT-23 package

Dallas Semiconductor's new DS1775 Digital Thermometer and Thermostat is claimed as the only digital sensor in miniature SOT-23 packaging that can maintain an accuracy of +/-2°C throughout the 3V to 5V power range. Readouts are adjustable from 9 to 12 bits of resolution.



The DS1775 indicates the device's temperature over a range of -55 to +125°C. Its five major components automate thermal control: a digital temperature sensor, analog-to-digital converter, data registers, thermostatic comparator, and two-wire system interface.

The user can choose from a range of readout increments, from the default of 0.5°C (9-bit conversions) to 0.0625°C (12 bits). The finest readouts are used in applications where very small temperature changes are critical and require immediate response, such as biomedical diagnostics. Once thermostatic setpoints are established, the user can configure either an interrupt or comparator mode to customize the method of clearing a fault condition. In power-sensitive applications, the DS1775 can assume a low-power, standby mode.

Applications for the DS1775 include disk drives in PCs, servers and workstations, environmental and biomedical diagnostic equipment, handheld instruments such as cellular telephones, or any thermally sensitive, electronically controlled system.

For more information contact Dallas Semiconductor, 4401 South Beltwood Parkway, Dallas Texas 75244-3292 or **http://www.dalsemi.com**.

Touch screen controller on a chip

Burr-Brown says its new ADS7845 is the industry's only complete, single-chip, 12-bit analog-to-digital converter (ADC) solution available for five-wire resistive touch screen applications.

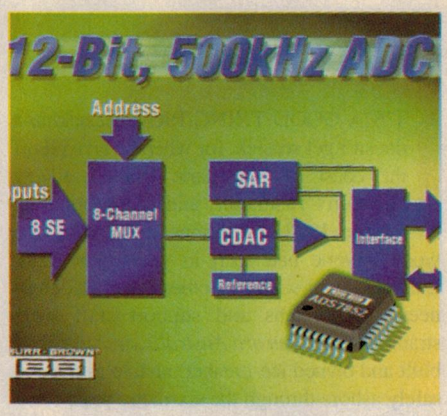
Clock plus thermometer on a single chip

Dallas Semiconductor has announced the DS1629 2-Wire Digital Thermometer and Real Time Clock, claimed as the first digital system component to incorporate a direct-to-digital temperature sensor, a real-time clock and Y2K-correct calendar on one chip. Previously designs for digitally monitoring thermally sensitive instruments and operating equipment have required a separate chip for each function, with separate programming configurations and interfaces.

The digital thermometer is accurate to +/-2°C, with 9-bit readouts in increments of 0.5°C. The user can even fine-tune a thermostatic response for extra sensitive applications, yielding 13-bit readouts in increments of 0.03125°C. The real-time clock/calendar counts time from seconds through years, with leap year compensation through to the year 2100.

For timed and/or thermostatic interrupt functions, the DS1629 has open-drain alarm outputs that activate at user-defined setpoints. All communication is accomplished through a standard two-wire serial interface.

For more information contact Dallas Semiconductor, 4401 South Beltwood Parkway, Dallas Texas 74244-3292 or **http://www.dalsemi.com**.

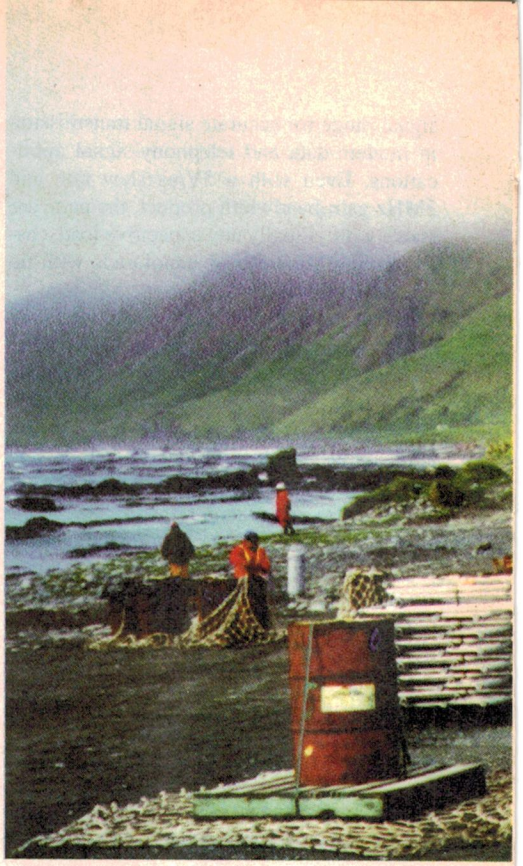


The device is claimed to offer improved performance, lower power consumption, and lower cost over all existing solutions. Its features make it ideal for battery operated and portable applications such as PDA (Personal Data Assistant) calculators, touch screen monitors, touch screen white boards, and other applications that employ a resistive touch screen element. In these applications, the ADS7845 measures a change in resistance as the screen is touched. The resistive change is then used to determine the exact location of contact upon a touch screen device.

The ADS7845 offers precision performance (compared to microprocessors with only 8-bit ADCs on-board), easy SPI/SSI serial interface, low power (<0.6mW at 75kHz data rate), and 'touch interrupt' to alert the processor that operation has begun. It can also operate in a sense mode (ratiometric) to minimize gain and offset errors due to driver offset, power supply, temperature, and touch impedance variations.

For more information contact Kenelec, 23-25 Redland Drive, Mitcham 3132. ❖

"It's no holiday..."



How would you like the job of installing a new radio Ionosonde antenna system for Australia's Ionospheric Prediction Service, in five days? It mightn't sound too bad, except that the antenna had to be installed on remote Macquarie Island, in freezing gale-force winds. Just about everything had to be transported on foot, too — not the easiest kind of antenna installation!

by Geoff McNamara

IT'S A GOOD THING Richard Luckhurst doesn't get seasick, for when he arrived off the coast of Macquarie Island midway between Tasmania and Antarctica in November 1997, conditions there were the worst anyone had seen in years. For days, Luckhurst and scores of other scientists, engineers, technicians and support staff were stranded on the *Aurora Australis*, an Australian built and owned ice-breaker, unable to make it safely ashore through the six-metre seas.

When he did manage to make it onto the island Luckhurst, who works for IPS Radio and Space Services, had his work cut out for him: install a new radio Ionosonde antenna system for 'sounding' the Earth's ionosphere. What made the task challenging were some of the most inhospitable working conditions this planet has to offer — and the fact that he had merely five days to complete the job.

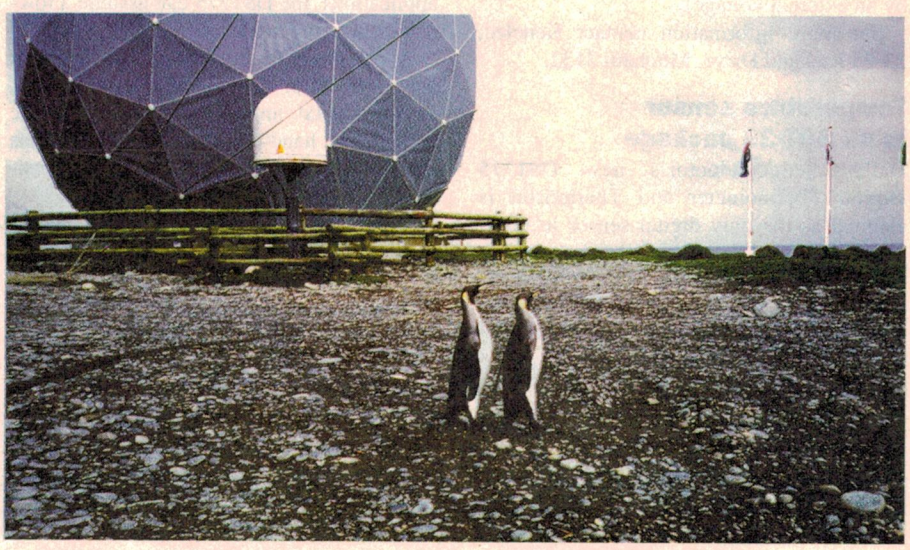
A radio Ionosonde is very similar to a radar device: basically a very high-powered transmitter that fires about a thousand very short pulses — each in the order of 40 microseconds duration — up into the ionosphere. The reflected signal is received by a second antenna. By comparing the two signals, scientists can learn a lot about the current state of the ionosphere.

For example, the time of flight gives the (virtual) height of the ionosphere. Other data include the minimum and maximum useable frequency of the ionosphere, the minimum and maximum point at which the ionosphere will reflect a signal, where there's any absorption, and any other strange features in the ionosphere. Such information is becoming increasingly valuable as many consumers — including the military — are turning back to radio communication.

The 4B/D Ionosondes operated by IPS have 576 channels, logarithmically spaced, from 1 to 22.6MHz. Each frequency is sounded three times with a 40us pulse. (The idea of the three pulses is to permit some hardware averaging, which reduces noise.) The whole sequence takes a little over 11 seconds.

The Ionosondes are spread over a wide range of longitude and latitude, so that an accurate picture of the ionosphere can be created in real time (see *Electronics Australia* December 1996). IPS operates Ionosondes at Mawson and Davis in Antarctica, Norfolk Island, Port Morseby and Vanimo in New Guinea, Hobart, Canberra, Sydney, Townsville and Mundaring. In addition, the Australian Antarctic Division (ADD) operates Ionosondes at Casey in Antarctica. IPS also receives data from Learmonth WA in conjunction with the US Air Force, and Auckland and New Zealand's Scott Base in Antarctica in conjunction with the University of Canterbury.

I asked Luckhurst was it really necessary to have a good longitude spread as well as latitude — surely the Earth's rotation would simply carry a given Ionosonde around the inside of the ionosphere once a day, so that it could map



A pair of penguins stroll nonchalantly past the dome covering Macquarie Island's ANARESAT satellite antenna...

The cargo resupply operation on Macquarie Island in December 1996. An elephant seal was objecting to the unwelcome intrusion.

out its behaviour? Not so, Luckhurst explained.

"A good spread in longitude as well as latitude is necessary because the behaviour of the ionosphere changes with local altitude of the Sun." Monitoring the ionosphere on a 24-hour basis, Luckhurst can see its daily variation from a number of longitudes.

With such a wide distribution of Ionosondes, IPS has a good coverage in latitude and longitude, but there's more to locating an Ionosonde than that. One of the original reasons for locating Ionosondes out in the middle of nowhere is to get them away from man-made interference — and to keep people away from them. "As you can appreciate, because we're transmitting across the spectrum from one to 21MHz, they used to create a bit of interference, although the newer units are quite clean", comments Luckhurst.

The original Ionosondes used square-wave modulators and were notorious for creating interference. While modern Ionosondes tend to use complex modulation pulses that produce virtually no interference at all for general consumers, Luckhurst said that older Ionosondes like the ones in Antarctica, Norfolk Island and a few other places transmit for an 11-second period which can cause significant interference to AM broadcasts for quite a few kilometres in every direction from the device.

Sounding the ionosphere is a process that goes on around the world, around the clock. "Ideally we'd like to sound every five minutes", says Luckhurst, "but the interference that Ionosondes tend to cause, at sites such as the Antarctic, prohibit us from doing that." And so soundings are made at least every 15 minutes.

"The ionosphere can change radically in those 15 minutes, especially at the higher latitude Antarctic sites", Luckhurst continued. The magnetic environment is so complex above the Earth's polar regions that there are rapid changes. According to Luckhurst, a sounding every 15 minutes is the very minimum, while "five minutes would be great!"

"One of the main reasons we can't use five-minute soundings in Antarctica is safety", Luckhurst explained. "HF radio is required for search and rescue operations, in particular when helicopter operations are underway. Field parties make their regular calls on the hour, so we shifted the hourly sounding to just before the hour. If we sounded at five-minute intervals we would sound at five past the hour, when the regular comms were still taking place."

The benefits of having Ionosondes in remote locations aside, it's still a difficult job getting them set up in places like Macquarie Island. To begin with, being a sub-Antarctic island means it is a very cold, very wet place. Protruding out of the Tasman Sea on the top of a volcanic ridge that runs south from New Zealand, Macquarie Island is tiny: only about 30km long from the northern to the southern tip, and a kilometre wide. And there's only one spot where there's any construction: at the northern end, where Australian Antarctic Division (AAD) has its base. Tasmanian Parks and Wildlife (TASPAW) will not allow any further development south of the ANARE base limits. This is to protect the island from people.

High on a hill...

The Macquarie Island Ionosonde was originally built on a hill on the northern end of the island near the AAD's base in the mid 1980s. This was a great location for a simple Ionosonde because it was a good distance from the AAD's receivers. Because the AAD then depended on high frequency for most of its communication, it was important to minimise the interference on the radio systems. "The last thing they wanted was an Ionosonde right next to their receiver while they're all trying to communicate with the mainland or listen to Radio Australia", Luckhurst said.

The situation became less of a problem in the early 1990s, when the AAD got what they now call the ANARESAT communications system. This is a permanent channel from each of the AAD bases through the various Intelsat satellites, back to Hobart. As a result, they don't depend as much on HF radio anymore.

Although far enough away to avoid interference problems, the Ionosonde was close enough for ANARE staff to visit the site every few days. Ionograms were once recorded onto 16mm film; every couple of days an operator would change the film, develop it, and analyse each frame to determine the various parameters that were needed. But IPS wanted to develop real-time models of the ionosphere and get this data back for use in forecasting, so it had to look at techniques to get the data back faster.

And so, in 1993, IPS decided to upgrade the various sites under its control. The first step was to modify the system so that the data was recorded onto a PC, so it could be analysed straight away. Once the data had been recorded by the PCs, the next step was to get the data back to the local AAD base.

Luckhurst went down to Macquarie Island in 1993 and set up a fairly rough and ready serial data transfer down to the AAD base. Luckhurst didn't lay any cable to do this, but made do with what was already there, joining just enough existing comms and phone cables to give him two pairs from the Ionosonde hut to the Science building using a couple of simple RS-232 to RS-485 modems. "It was a rough job simply because you can't go digging cables everywhere in a four day change-over", Luckhurst said. "You use what's available."

IPS also wanted to upgrade the site by installing a second antenna. The old sites used a single mast with two delta antennas mounted: one for transmit and one for receive. But the setup limits what can be done and prevents what Luckhurst describes as "some fancy polarisation measurements", which require two masts.

It's no holiday...

Setting up a new antenna anywhere else would be a relatively simple job. The problem with Macquarie Island is that because it's a volcanic outcrop, there's very little rock and a lot of sand and waterlogged bog. Luckhurst's predecessors chanced on a rocky outcrop when they put the first antenna up in the 1980s, but when he arrived with four army riggers who would install the mast, they couldn't find any land that would support a second mast...

Just the start

But this was just the beginning. Conditions on the island are difficult by any standard, not just for the workers but also for the equipment. Not only is it always cold, with temperatures seldom measured with positive numbers, but it's clouded over most of the time. "If you see the Sun from there for more than a few hours, you're doing really well", Luckhurst commented, adding that between the constant rain and high winds there's a high wind chill factor.

So it's not surprising that even the building had suffered to the point where it needed to be replaced. It had served its purpose well, and was one of the most cost-effective buildings in Antarctica: a $200 commercial garden shed sprayed on the inside with foam for insulation, flown in by helicopter and bolted it to a concrete pad. And that worked fine for 10 years; the worst it ever suffered was when the door blew off once during a storm. Other than that, said Luckhurst, it survived beautifully.

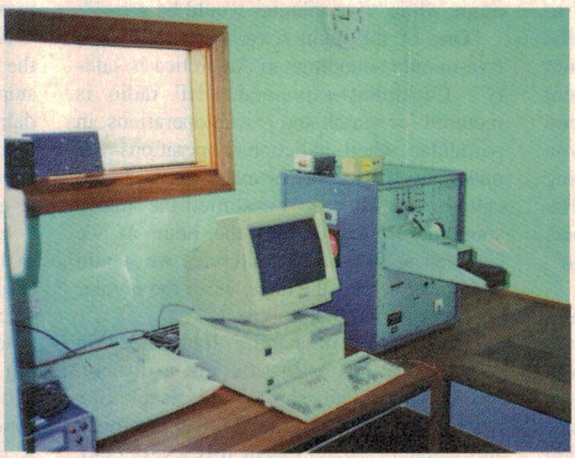
But it was time for a change, and so IPS decided to build a new site at the southern end of ANARE station in 1994. There were a number of advantages in this: for a start, there was already one mast there; it was close to the AAD's HF transmission site ("It didn't really matter if we were belting pulses up and down in the air, as long as our system could accept the fact that it was near an HF transmitter"); and it meant no one had to trudge up a hill every few days.

The new site was built in 1994 by ANARE wintering carpenters and staff. Luckhurst arrived in late 1994 to install the new antenna system. The existing Ionosonde was lifted to the new location by helicopter. Then, in five 12 to 14-hour days, Luckhurst and his colleagues put up two new fairly elaborate antenna systems, a lot of cable, and a lot of conduit — all in temperatures around zero degrees Celsius and constant gale-force winds.

The new site had the advantage of an existing cable running the 800 metres from the transmitter hut to the communications building, including power, phone and fire monitoring. Luckhurst had to add about 200 metres of cable to the new Ionosonde hut. It was important to get data from the three Antarctic Ionosondes back to Sydney as quickly as possible, and so Luckhurst also set up a UNIX computer at each site. These were hooked up to the ANARE station's LAN, and from there a link was established with the IPS Sydney site, enabling the data to be downloaded once a day.

Luckhurst returned to Macquarie in 1995 to finish a few jobs and make minor modifications. "I didn't think I'd be going back there for a while", he said. But by early 1996 the high salt content in the sand had caused a considerable corrosion in the cable that was running between the science building at the north end of the island and the new Ionosonde hut, and the quality of the communications link was deteriorating. IPS was also having trouble with the PCs and other equipment, even though everything was in heated buildings.

Richard Luckhurst outside the IPS ionosonde hut on Macquarie Island in December 1996. Note the fence, to provide protection against seals.



Inside the ionosonde hut: an IPS 4D Ionosonde, with PC used for logging and communications.

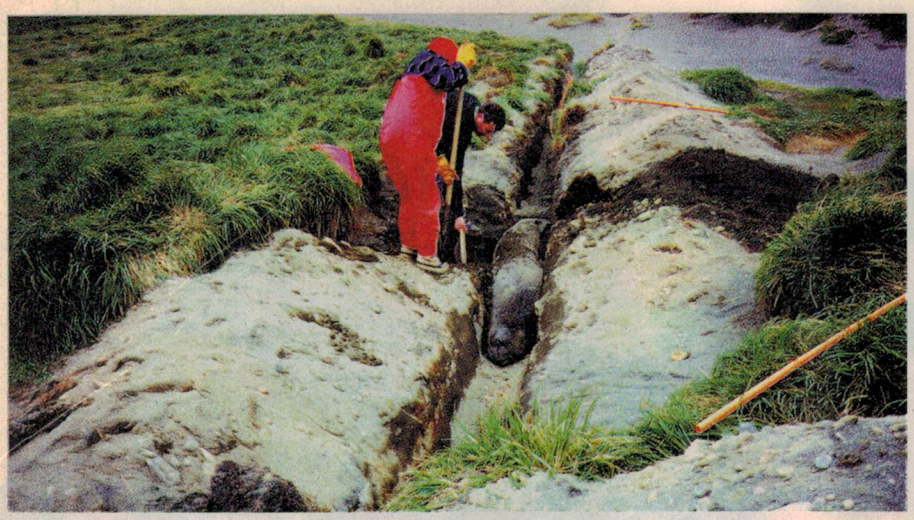
Back again!

Come December 1996, Luckhurst found himself back on the island with the task of replacing the entire system — only this time there would be no cables attached. "Because of the problems associated with getting the data back over the serial link, we decided to set up two UNIX computers and replace the serial cable with a spread-spectrum radio link", Luckhurst explained.

The decision to set up a spread-spectrum radio link involved more than simply maintenance considerations. Macquarie Island is part of the Tasmanian State Park, and this means you can't simply dig kilometres of trench for cables. Digging trenches on Macquarie Island involves firstly going through the process of getting permits off the Tasmanian Parks and Wildlife Service, and even then you're only allowed to dig at certain times of year when the penguins and albatross are not breeding, and so on. "It's a logistic nightmare", comments Luckhurst. Further, while on the mainland you'd use a backhoe to dig a trench, on Macquarie Island there's no such thing. The whole job is done with a shovel, something Luckhurst describes as "an interesting experience".

Another problem with laying cables on Macquarie Island is the local population of elephant seals. "They're everywhere", says Luckhurst, who recalled that whenever he ran a cable an elephant seal would get in the way or crawl over it. "One fell into a conduit trench and we had to dig him out before we could lay the cables", he said. At any rate, Luckhurst points out, "the environment's just too fragile for that sort of earth works."

And so it was decided to use radio to link the computers.



A not-so-slight problem: an elephant seal fell into the ionosonde comms cable trench, and became stuck...

Spread-spectrum link

Luckhurst spent a fair bit of time developing a spread-spectrum link, using commercial modems and playing around with PPP software so that it would work over a spread-spectrum radio link. He managed to get a fairly good link working, getting about 28.8 kilobits/second between two PCs. "It's as if your two machines are connected by a physical cable!" Luckhurst said. "I can sit here in Narrabri, Telnet into one of the machines, Telnet from that one to the other, and check out the machine that's sitting out in a timber hut a kilometre from the station and see what the Ionosonde is doing."

"It was quite interesting mucking around with these spread-spectrum data links", Luckhurst recalled. The original '4B Ionosondes' were mainly manufactured in the early 1970s and used a very early printed circuit board technology. Luckhurst describes one of the unique challenges facing such devices in an environment like Macquarie Island: "The back planes of these things are wire wrapped, and as you can appreciate if you have wire wrapping and poorly produced printed circuit boards in a high salt air environment, you're going to get a lot of corrosion. So it's quite funny seeing the back of these circuit boards and the wire wrapping covered in white foam and fungus. You're not game enough to touch it, because you know full well that it's going to fall to pieces if you do. These poor old things just struggle along."

Antennas destroyed

Unfortunately, the antennas hadn't been so robust. Made from 3.2mm galvanised wire very similar to clothes line wire, and large fibreglass spreaders to hold them into their delta shape, the antennas were later destroyed by storms accompanied by 100km/hour winds. The masts had survived,

The IPS 'garden shed' ionosonde hut installed on Macquarie Island in December 1993, with antenna mast. (All photos are courtesy Richard Luckhurst, IPS Radio & Space Services.)

but the wire elements and fibreglass spreaders were damaged beyond repair.

And so, a year later, Luckhurst found himself stranded on a rolling ship within sight of the island. "We had a very bad run", he recalled. The first two days of the trip had been uneventful, but the *Aurora Australis* hit bad weather the night before it reached Macquarie Island.

"Previously I've seen reasonable conditions, with cloud and rain. But this time we hit a bad year and got stuck out on the ship for a few days — conditions were just too rough to go ashore. When we finally got

(Continued on page 91)

A few hectic days...

VISITS TO PLACES like Macquarie Island are rare, and so for the 15 to 20 people who stay behind — wintering, as it's called — life gets awfully crowded when the supply ship finally arrives. Usually about a hundred people converge on the island, undertaking a variety of scientific activities. Within a few days they have to transfer to the island a year's food and power supplies, quarter of a million litres of fuel (called 'special Antarctic blend' — diesel that doesn't freeze), and replacement personnel. "It's all done with a couple of helicopters and a lot of work", says Luckhurst.

Transport on the island is mainly by foot: two tractors and one four-wheel drive forklift can only do so much. "You lug and carry everything on Macquarie Island", comments Luckhurst, who tells a tale of one team who had to walk 30km carrying PCs on their backs.

The island can't accommodate everyone, and so about 20 to 30 people 'commute' to and from the ship by helicopter or in Zodiac rubber boats. Of those who stay on the island while the ship is in, some (mainly Biologists) head out into the field, staying in small huts and do not return to the base until just before the ship sails. Even so a kitchen that usually prepares meals for 15-20 people is stretched to the limit cooking for so many people. So many visitors also puts an enormous strain on the fresh water and sewerage system.

Even finding somewhere to sleep is a challenge. The place is so crowded with a hundred people that they sleep in every nook and cranny. Luckhurst's favourite sleeping place is a photographic darkroom: "Being so far south you only get four or five hours of darkness a night", Luckhurst explains, "and it's nice to find somewhere that's really dark." He adds that with work going on 24 hours a day, it's nice being able to lock the door and get some quiet.

Everyone has multiple roles on Macquarie Island. The diesel mechanic has to look after four vehicles and the power station's diesel engine; the electrician has to look after everything from changing a light globe to running the power station; meanwhile the radio technician looks after VHF field radios plus the satellite station for Intelsat communications. All this calls for more support people than scientists.

It's no holiday, and at the end of it all there's virtually no financial reward for such a trip. "You go because you want to," says Luckhurst, "not for the money."

Motorless motion with Muscle Wires

They're silent in operation, are one of the few ways of converting electrical energy to mechanical force without the use of magnetic fields, and have a force/weight ratio that you wouldn't believe. They are muscle wires, and they've found their way into everything from surgery to robotics. They've even found their way to Mars! We took a look at some, along with a comprehensive project book from Australian distributor Robot-Oz.

by Graham Cattley

ELECTRONICS AS A HOBBY is quite rewarding, and if you are reasonably competent with a soldering iron you can come up with a variety of worthwhile and interesting projects. After a while though, a strong urge to be creative tends to surface, and this is something that soldering part A into hole B doesn't quite fulfil.

It's at this stage that (if you are like me) you look around for a something that satisfies the need to create something spectacular — while still being fundamentally electronic, of course. In almost every case, this path leads to robotics: a field that involves mechanical fabrication, a good deal of electronics, and the warm inner glow of seeing your creation lurch off into the distance!

One of the more popular fields of robotics is BEAM robotics. BEAM stands for Biology, Electronics, Aesthetics and Mechanics, and it is mainly concerned with the design and construction of small, lightweight insect-like robots that are often solar powered. Due to the simple nature of these robots, and the fact that part of the BEAM ethic is to use recycled or cannibalised parts from other equipment (such as walkmans etc.), BEAM robotics is ideally suited to the hobbyist, and the number of ingenious BEAM designs out on the net in personal home pages is huge.

One drawback with BEAM designs is that they often use specialised miniature motors and actuators, which you can't easily buy at your local hobby store. And even if you *do* come across a reasonably sized actuator, chances are that you'll need at least two of them to get your design moving. This, plus the fact that motors and solenoids tend to be heavy and difficult to mount (as well as needing gear trains, belts and pulleys) leads one to think that there must be a better way. And there is...

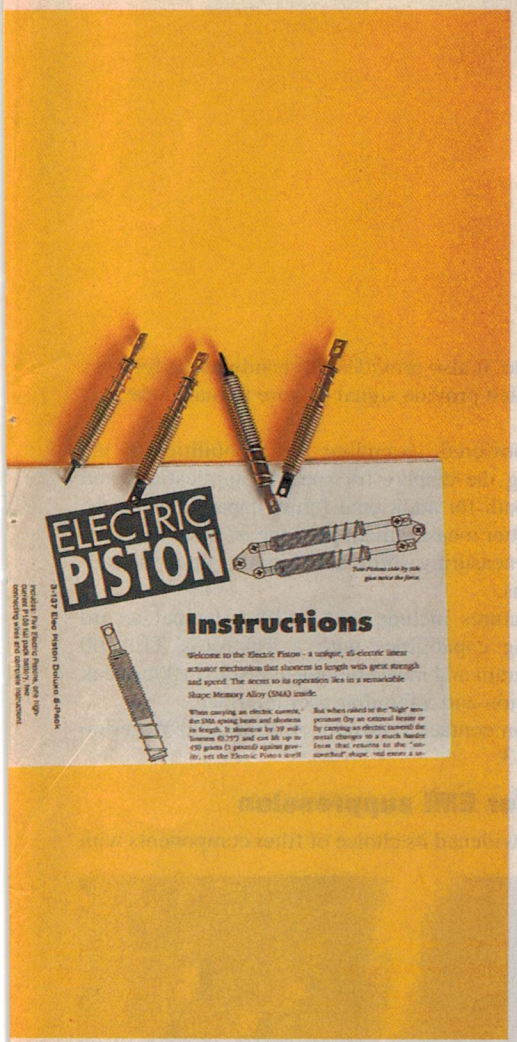
Muscle Wires

Back in 1932, Swedish researcher Arne Olander noticed that a gold-cadmium alloy exhibited a 'shape recovery' tendency. Little work was done on the subject over the next 30 years, and little use was found for the alloy — partly due to the cost of the gold, and the toxicity of the cadmium. In 1969 several new alloys were found that exhibited the same shape recovery properties, and out of the bunch, a 50/50 nickel-titanium alloy was found to give the best results.

So what is shape recovery? It's the ability for a metal to return to its original shape after being bent or otherwise distorted. Many materials do this to a certain extent, however the shape memory alloys (SMA) add an extra twist — they will return to their original shape only when heated above a certain temperature. A short length of nickel-titanium alloy wire can be bent and will hold its form in much the same way a piece of copper wire will, but when dipped in a cup of hot water it will instantly spring back to its original shape with surprising force.

Known as Nitinol, this shape memory wire lends itself to BEAM robotics, as it is light, easy to work with, and is quite strong. Muscle Wires are lengths of Nitinol that are 'pre-shrunk' at the factory, and when heated they will contract or shrink by around 4-5%. This doesn't sound like much, but that translates to 4-5mm on a 10cm length, with up to 950g pulling force, which can yield impressive results with a simple pivoting arm.

Muscle Wires come in a range of gauges from .037um up to the more sturdy 250um, and two temperature ranges: 70° and 90°. They have a resistance ranging from 1.8k down to 20Ω per metre (depending on the



gauge) and so can be activated by simply passing enough current through them to cause self-heating. The finest (0.037um) needs only 20mA to bring the wire to its 70° transition point, while the 250um needs up to an amp, depending on local conditions (ambient temperature, air flow, etc.).

The one main problem with using Muscle Wires is that they can easily be over heated. If too much current is allowed to flow, the wire temperature will increase and will eventually re-anneal the wire — preventing it from being re-stretched to its longer form. Ideally, therefore, some form of constant current circuit should be used to drive the wire. A simple series resistor can be used instead, although this is rather wasteful as the excess energy is dissipated as heat.

Project book

If all this sounds interesting, then you really should get yourself a copy of the Muscle Wires Project Book, which is currently in its third edition and is available along with sample packs of Nitinol Muscle Wire.

We got in touch with Robot-Oz, an Australian robot parts supplier, who sent us a copy of the book, along with the deluxe sample kit containing three one-metre rolls of Muscle Wire. This is enough to construct all the projects in the book, and still have some left over to play with.

The book starts off with a brief history of SMAs, a rather lucid explanation of how SMAs work, and gives some examples of various SMA products in use today. It then moves on to the more practical aspects of using Muscle Wires, with full technical specifications, mounting and terminating requirements, and other mechanical aspects of using them in your application.

It's the last section of the book that is the most interesting however. Over a dozen Muscle Wire projects are featured, ranging from the simplest linear-action weight lifter (a Muscle Wire lifting a bag of coins), through to a proportional remote control interface. There are also two rather complex projects at the end of the book: a computer interface circuit based on a pre-programmed 8052 microcontroller, and Boris, a six-legged walking machine.

Boris looks impressive, being built from lengths of piano wire and foam board or balsa wood, and he is controlled by a BASIC program running on a PC. When you read through the instructions though, Boris starts to look complicated. There's a fair amount of cutting, bending and gluing, and the need to tension all eight Muscle Wires correctly. You'll also have to build an eight-transistor interface, to allow the PC to drive the robot, and while I'm sure that the end result is effective, it isn't going to be one of those Sunday afternoon projects.

One point that I might make here is that the book is American, and quotes American suppliers for the more specialised parts needed for some projects.

There's another more important point I'd like to make about one of the suggested projects though. The AC Lamp Flasher project uses a Muscle Wire actuating a micro switch, which in turn controls the mains supply to an AC outlet. This is all very well, however the design calls for one end of the Muscle Wire to be connected directly to the mains. This is extremely dangerous, particularly as the book encourages you to blow across the Muscle Wire to note the effect on the switching frequency!

This blasé attitude may possibly be acceptable in the US with a mains supply of 115V, but here in Australia the 240V mains will kill you. I'm surprised that there wasn't a note included in the exported copies warning of the dangers — particularly as an erratum slip had been stuck to the inside front cover. All I can say is that if you buy the book, please do NOT build this particular project.

The Muscle Wire Project Book is a must if you intend to use Muscle Wires on your design. It contains all the technical information you'll ever need, and is well worth the money for this alone

Electric Pistons

Small, electrically operated pistons that can pull up to 450g.
Good points: *Proportional control is possible, small and lightweight (10g).*
Bad points: *High current drain (4 to 5A), and have a slow cycle time of 5-10 seconds.*
RRP: *$76 for a pack of five pistons*
Available: *Robot-Oz, 7 Felgate Pl., Warwick, Perth WA 6024. Phone: (08) 9246 1573; Fax (08) 9246 1563; Email: kits@robotOz.com.au; Website at* ***http://www.robotOz.com.au***

Electric Pistons

As well as the Muscle Wire Project book, Robot-Oz also sent a pack of five Electric Pistons. These look for all the world like miniature shock absorbers, and are quite ingenious. Each consists of a 50mm long brass cylinder housing a 'plunger' with a 20mm stroke. Inside, a small coil of Muscle Wire is stretched as the piston is extended, and when current is applied, the spring heats and contracts, exerting up to 450g of force. Once the spring has cooled (around 5-10 seconds) the plunger can be extended again.

Note that the pistons can only pull — like Muscle Wires, they require the load to stretch them back into their extended state.

Supplied with the pistons was a Polaroid Polapulse flat-pack battery and a 12-page instruction booklet. The battery is ideal for experimenting, as it can supply the 4-5A required to pull-in a piston. Obviously with such a high current drain they don't lend themselves to normal battery operation (or BEAM robotics for that matter), but with a suitable power supply you should be able to use them in higher-power designs.

The instruction sheet covers a number of Electric Piston projects, and also shows how two pistons side by side can give twice the pulling power, while pistons mounted end to end give twice the stroke.

(Continued on page 91)

New Products

DSO provides 3GHz bandwidth on 4 channels

Tektronix' new TDS694C digital storage oscilloscope (DSO) provides the highest bandwidth and sampling rates available for accurate measurement of high-speed digital signals. The four-channel, 3GHz bandwidth DSO can simultaneously sample up to 10GS/s on all channels.

With the TDS694C, engineers can connect the powerful DSO to their device under test (DUT) and perform system characterization, verification and validation, as well as high-speed timing and jitter measurements. For example, it's claimed ideal for characterizing signals in microprocessor systems and components such as motherboards, chip sets and graphics accelerators.

The TDS694C provides high-accuracy timing capability, including trigger jitter of 7ps RMS and delta time measurement accuracy of up to +/-15ps, which allows users to characterize jitter, edge speeds and timing between edges, all with minimal influence from the measurement device. It also provides full bandwidth edge-triggering capabilities, which provide signal capture to match the performance of the DSO.

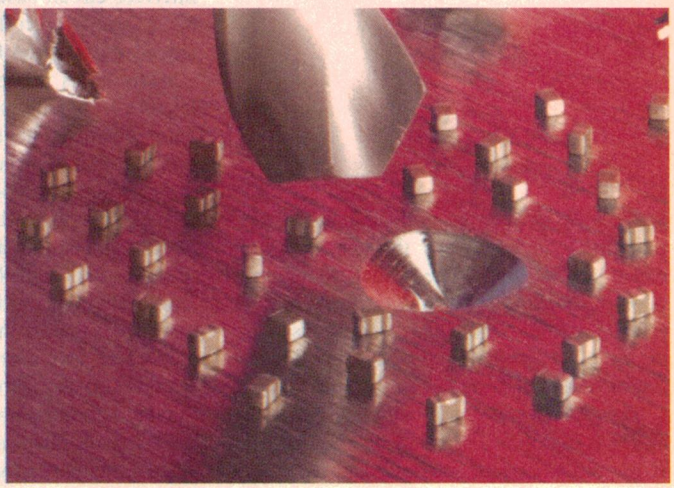
The DSO is Java-powered, extending the capabilities of the basic scope, enhancing the display for specific applications and offering a continued path for additional future capabilities of the scope. The available jitter measurement package is especially useful for automatically measuring and characterizing jitter in leading-edge digital designs.

Other TDS694C features include up to 120K channel record length, cross-triggering capabilities with a Tektronix TLA700 Logic Analyzer, histogram and measurement statistics, 100ps peak detect for glitch detection and a familiar user interface.

For more information contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113.

0805 chip cap for EMI suppression

Syfer Technology has widened its choice of filter components with



Programmable AC power source with GUI

The new California Instruments 2001RP precision AC power supply can supply up to 2000VA at frequencies from 16Hz to 5000Hz, making it well suited for tasks including development and ATE.

The ability of the 2001RP to provide high peak currents, typical of non-linear loads, and to handle power factors from 0.00 to 1.00 without derating, makes the AC source ideal for a wide range of equipment including switch-mode power supplies. An optional power meter module provides measurements including RMS current, voltage, true power, crest factor and peak current, thus allowing the use of the 2001RP as a 'single box' power test system.

For ATE applications, the 2001RP can be provided with an optional IEEE488 or RS232 interface. A Windows graphical interface permits control of the power supply from a PC.

For more information contact Westek Industrial Products, Unit 2, 6-10 Maria Street, Laverton North 3026.

an 0805 feed-through chip size, perfect for EMI suppression, broadband I/O filtering and DC power line applications. The low inductance to ground of these chips offers excellent decoupling capability in all high di/dt environments and provides significant noise reduction in digital circuits.

To give design engineers the maximum choice of insertion loss characteristics, a number of capacitance values are offered in COG or X7R dielectrics and rated at 100V or 50V. These range from 22pF to 820pF in COG and from 470pF to 47nF in X7R. In all cases, the current rating is 300mA. Other benefits include high insulation resistance and DC resistance less than 0.6Ω.

Providing an easy route to broadband EMI reduction while saving valuable PCB space, these 0805 feed-through capacitors will be applicable to many different industries.

For more information contact Tri Components, phone (03) 9560 2112.

CCD cameras for machine vision

JAI of Denmark have introduced a range of M-Series cameras for machine vision and surveillance. The cameras use a new Hyper HAD sensor to achieve high sensitivity, wide dynamic range and very low smear.

The monochrome range includes the M50, a 1/2" CCD and the M300, a 2/3" CCD sensor. For high speed scanning, the M30 is capable of double speed scanning at 120 fields/sec and partial scanning up to 360 fields/sec. The M10 is a progressive scan camera which is capable of two-field output in parallel.

In the colour range, the M70 is a high resolution RGB progressive scan camera, wrapped in a unique compact housing and specially developed for industrial vision applications. Features include RGB primary colour mosaic filters for high colour rendition, manual or auto tracking white balance, shutter 1/60 to 1/10000 second, 2 - 16 fields integration, pixel clock, HD, VD/WEN out for easy interface and RS232 interface for Windows NT.

The M90 is a three-chip CCD RGB colour camera, capable of interlace/non-interlace scanning. It has frame/field accumulation and also an RS232 interface (Windows NT) for easy set-up.

For more information contact The Dindima Group, (03) 9873 4455.

Compact 1500W power supplies

Now available from Powerbox Australia are three new 1500 watt switchmode power supplies recently released by the Westcor Division of Vicor Corporation. These standard units incorporate Vicor's high power density 'second generation' modules.

The 48V DC PFC Mini is particularly compact, delivering 1500W from a package only 1RU (44.5mm/1.75") high and a power density at over 11W/in³. The 28V DC PFC Mini offers

excellent performance for defence COTS programmes. This unit also delivers 1500 watts. Finally, the 24V DC PFC Mini is well suited to applications in the fast-growing cellular market, where 24 volts is needed to work with back-up battery sources. Full power of 1500W is provided at 45°C.

These three standard models represent just a fraction of the possible configurations, because the PFC Mini offers up to six outputs, which can be custom-configured to the application requirements. Each unit measures 44.5 x 152.4 x 304.8mm.

For more information contact Powerbox Australia, 4 Beaumont Road, Mt Kuring-Gai 2080.

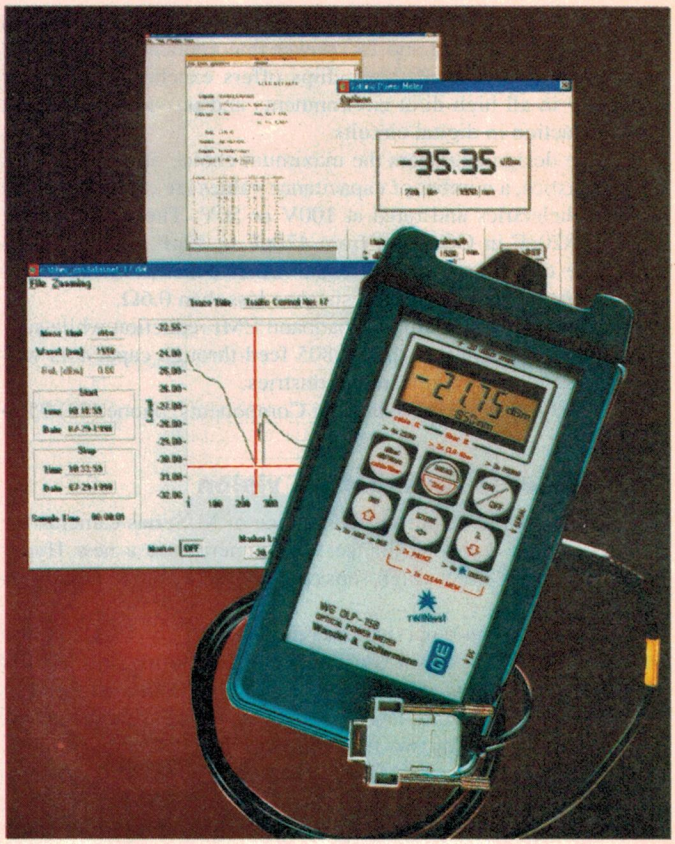
Handheld optical power meters

The new B-series of Wandel & Goltermann's handheld optical power meters is claimed to pack bolstered perfomance at the existing price level. Unlike their predecessors, the high performance power meters (OLP-15B, OLP-16B, OLP-18B) can store 1000 power level and attenuation values along with the wavelength. The stored data are structured according to cable and fibre number.

These features are advantageous when installing and accepting larger networks. An RS232 interface for data transfer and remote control application is also new. Optically speaking, the choice between exchangeable adaptors and a universal push-pull system fitting all 2.5mm connectors (eg ST, SC, DIN, FC, E2000) is also new. More wavelengths are available as well: 780nm for HYTAS applications, 1480, 1510 and 1625nm for monitor cables.

Along with the improved meters, Wandel & Goltermann has also introduced its FiberASSISTANT software for PC-supported applications. FiberASSISTANT can read out measurement results stored in the handheld power meters, or record the data itself while remotely controlling the meters. Adjustable parameters, Pass/Fail assessments and results storage in prepared cable files speed up testing and simplify documentation. FiberASSISTANT runs under Windows 95, NT and 3.11.

For more information contact Wandel & Goltermann, 42 Clarendon Street, South Melbourne 3205.



Compact, low cost logger

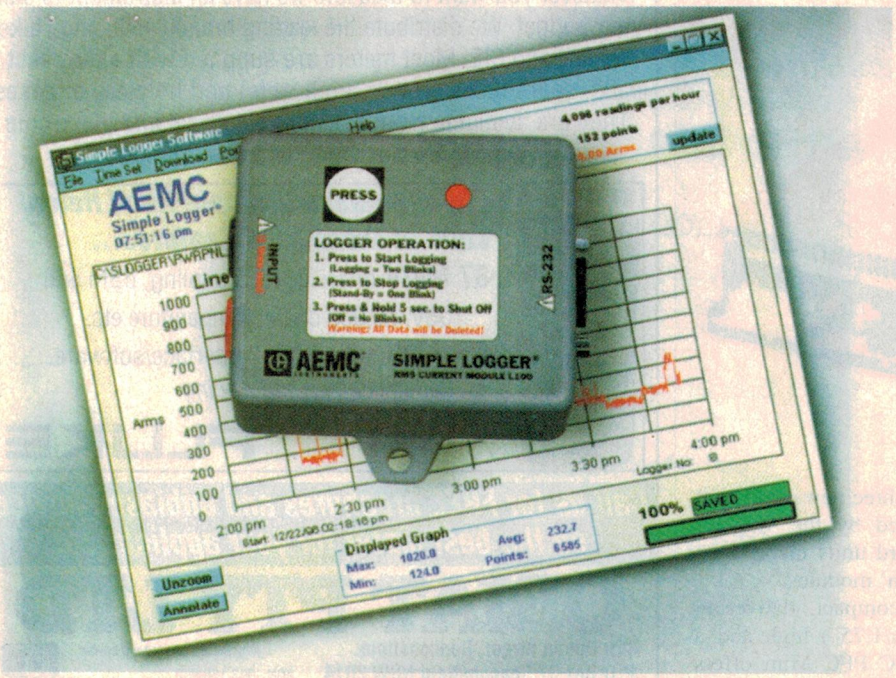
Simple Logger is a single channel, low cost data logger that requires no user setup. It has the ability to adjust automatically both its scale range and sampling rate, to optimise the recording session. An included Windows based software package can plot and analyse recorded data, and can print graphs and data listings.

Three operating modes are available with Simple Logger: Logging, Standby and Off. A red LED indicates the mode of operation. In the Logging mode, the logger records information in memory; in Standby mode, it retains the recorded information for transfer to the computer; and in the Off mode, the memory is cleared. However if the unit is turned off by mistake, the cleared data can be easily recovered.

Other features include true RMS AC measurements, low power consumption (operates for up to a year on a 9V alkaline battery), memory storage of 8000 readings and simplified one-button operation.

The main advantage of Simple Logger is its ability to perform a wide variety of recording tasks with high resolution and accuracy, without the need for user setup. It achieves this by means of automatic scaling and Time Extension Recording (TXR), along with flexible input design. Typical applications include machine load monitoring, HVAC troubleshooting, line voltage/stray voltage monitoring, process control monitoring and food storage/refrigerated freight monitoring.

For more information contact Obiat, 129 Queen Street, Beaconsfield 2014 or phone (02) 9698 4111. ❖



Interesting Components for Robotics:

(Continued from page 87)

Summary

Muscle Wires have a lot going for them, and with a well thought-out design the results are amazing. They do have some disadvantages though.

They aren't cheap, for example. Muscle Wire sells for around $35 a metre, and a sample pack of ten 20cm lengths will set you back $70. They are also rather fragile; Heat from soldering will permanently damage them, and so all electrical connections really need to be clamped or crimped. Excess current will also overheat them, and a brief encounter with a 6V battery will render a Muscle Wire useless within a second. (No prizes for guessing how I found *that* one out...)

The Muscle Wire Project Book is a must if you intend to use Muscle Wires on your design. It contains all the technical information you'll ever need, and is well worth the money for this alone. The projects described in it tend to be either very simple or very complex, which means that you may be inclined to skip over the basic designs to get on to something 'real'. But there are no problems with this, so long as you realise that Boris is going to take a few evenings to construct, and things like setting wire tension are going to be a bit fiddly.

You'll find Muscle Wires mentioned on various sites on the net, including Mondotronics Inc. (the US suppliers of Muscle Wire products) at **http://www.robotstore.com**, and Robot-Oz at **http://www.robotOz.com.au** who are the Australian distributor. There are also a million robotics pages out there that can offer some good design ideas — so if you are feeling creative, have a go! ❖

Muscle wires & project book

Wires that shorten by 4-5% when heated, producing up to 2kg of force.
Good points: *They work well, and are ideally suited to small scale robotics.*
Bad points: *They must not be allowed to overheat. Project book is American and contains one potentially lethal project...*
RRP: *Project book with Deluxe Muscle Wire kit $110. Muscle Wire sample pack (two metres) $70. Full pricing on website.*
Available: *Robot-Oz, 7 Felgate Pl., Warwick, Perth WA 6024. Phone: (08) 9246 1573; Fax (08) 9246 1563; Email: kits@robotOz.com.au; Website at* ***http://www.robotOz.com.au***

It's no holiday...

(Continued from page85)

there it was snowing and raining all day, not to mention the six-metre seas. This is all pretty unusual for this time of year and made it very unpleasant for working."

This time around, IPS redesigned the antennas using stronger construction techniques and stainless steel, and Luckhurst took the entire new antenna system down with him. The problem of poor foundation prospects remained, and so the antennas had to be mounted on concrete cubes one and a half metres on a side. The new tri-section masts had 300mm sides and were stabilised by guy ropes attached to similar concrete blocks.

In the end, the effort paid off. Late each night IPS can now retrieve ionospheric data from Macquarie Island and other Antarctic sites. Luckhurst is modest about how successful his efforts have been, but admits that he now has unusually good access to the Ionosonde data from Macquarie Island:

"Funnily enough, the only other sites we get data back of such quality are from the mainland sites where we rely on dial-up modems and all sorts of horrible software to get the data off them", he said.

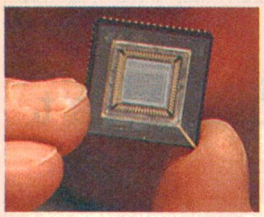
Getting data from Ionosondes at places like Norfolk Island and Mundaring still depends on Zip disks being sent through the mail, simply because IPS hasn't had the time to develop those sites. But the unique conditions that prevail over the Antarctic sites forced IPS to use makeshift technology to get the data back, simply because they didn't have the time to get it back any other way. In the end, they worked better than any other site.

No doubt this won't be the end of the upgrades at Macquarie Island or the other Antarctic sites. New Ionosondes are already being made in Sydney and Canada, and will be shipped to Antarctica when they've proven themselves up to the task.

"The new Canadian Units (called CADI: Canadian Advanced Digital Ionosonde) don't yet have new sites to go to", Luckhurst explained. "There is also no plan yet of where they will go."

Initial testing is looking pretty good, he continued: The units have a lower transmitter output power and they use a complex transmitter pulse to achieve results with lower power and to minimise interference."

No matter how well planned the technology, however, Luckhurst's experiences at Macquarie Island serve as a reminder that technology is only half the story when it comes to progress. In the end, there's no substitute for innovation and human endurance. ❖



Silicon Valley Newsletter

VLSI & Philips agree on $1.2B bid

AS MANY PREDICTED, Dutch electronics giant Philips and Silicon Valley chipmaker VLSI Technology brought their two-month hostile take-over battle to an abrupt end as the chipmaker accepted Philips' sweetened US$1.2 billion acquisition offer. The revised settlement price represents a handsome US$427 million windfall for VLSI shareholders, who were offered $777 million in the original bid.

Philips and VLSI said they had agreed on a $21-per-share sale price, up from the original $17 offer. "After reviewing non-public VLSI information and meeting with VLSI management, we have concluded there is additional value in the company", said Arthur van der Poel, chairman of Philips' US$4.5 billion semiconductor division.

Philips persisted with the takeover, from which it stands to gain access to premium telecommunications IC technology the company needs to power its cellular telephone and mobile computing products and other consumer electronics products. The company has also said it wants to use VLSI as a major stepping stone for expanding Philips' interests in the US IC market. After the acquisition, Philips will rank as the world's sixth-largest semiconductor company.

Despite putting up a tough fight, VLSI chairman and chief executive officer Alfred Stein said he would remain with the company to oversee the integration of VLSI into Philips. After the process is completed, Stein, who is 66, said he plans to retire. "Together, we can accomplish far more for the benefit of our constituents than either company could do as standalone entities," Stein said of the settlement.

Philips has long been a well-established member of the Silicon Valley electronics community. The company previously purchased the Signetics chip firm in the late 1970s. Philips' semiconductor operations employ some 1800 people in the area. The firm is also setting up a large communications products operation in Fremont.

Motorola agrees to sell chip unit

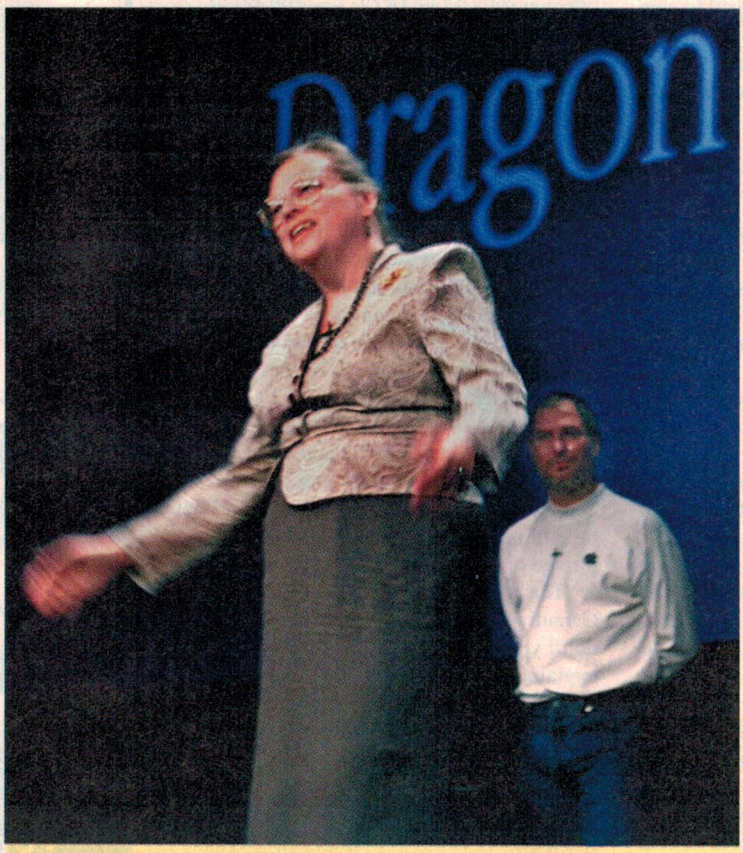
MOTOROLA HAS ANNOUNCED its acceptance of the US$1.6 billion offer to sell most of its $7.4 billion-a-year semiconductor operation to the Texas-based Texas Pacific Group. The move surprised industry analysts, who had expected Motorola to accept a similar $1.6 billion bid from Semiconductor Components Group, representing a group of current and former Motorola executives.

Under the terms of the TPG deal, Motorola will retain a 10% stake in the operation. The sale will enable Motorola to focus its semiconductor interest on its embedded logic IC business.

"This transaction will enable SPS (Semiconductor Products Sector) to focus on embedded solutions leadership. The component business, while viable, is driven by different customer demands. This transaction should enable both organizations to pursue their independent strategies more effectively", commented Hector Ruiz, president of Motorola's SPS unit.

While profitable, the SPS group, which markets more than 20,000 basic IC components, has generated slow sales growth in recent years. Due to the inherent low cost of most of the SPS products, profits have been small as well. Motorola has been shopping for a buyer for the components group for about a year.

Texas Pacific said it has been in talks with Motorola for nine months and had been in exclusive negotiations for several months. Texas Pacific is based in Fort Worth and San Francisco. It will combine the SPS operations with those of Zilog, which was purchased a year ago for US$600 million. TPG also owns a majority position in Elektrowatt AG's pay phone unit, the world's largest supplier of pay telephones.



At Apple's annual World Wide Developers' Conference held in San Jose in May, interim CEO Steve Jobs (right) stood in the background while Dr Janet Baker, Chairman and CEO of Dragon Systems Inc announced that her firm will create and market Macintosh-compatible products based on Dragon's Naturally Speaking, the top selling retail continuous speech recognition product in the USA. (Business Wire)

Microsoft teams up with Nextel

JUST THREE DAYS after agreeing to invest some US$5 billion in AT&T, Microsoft made another large move in the telecommunications market with a US$600 million investment in Nextel Communications, whose merger talks with MCI-WorldCom have fallen apart.

Microsoft and Nextel will jointly develop products and services to provide Internet access for wireless phones. As part of the cooperation, Nextel will set up and operation an online site through which it will supply e-mail,

calendar and address book functions for a new Motorola Internet cellular phone which is expected to be rolled out later this year. Also transmitted to the new phones will be stock prices, news, sport scores and other information.

Nextel will use most of the $600 million to help finance a major expansion of its wireless network. Microsoft will also receive 4.25% of Nextel's stock.

Telecommunications appears Microsoft's next major area of interest. During the past two years, the company has been investing in the cable TV market in order to secure marketshare for its Windows CE-based set top box operating system software. That culminated in the US$5 billion investment in AT&T, which, after the acquisition of MediaOne and Telecommunications Inc, will be America's largest cable TV provider, as well as the largest Internet and long distance service provider.

Both cable and telecommunications markets represent vast new potential areas of growth for Microsoft. While it dominates the market for computer operating systems, growth in that market is levelling off and Microsoft will need new large markets to continue to grow at the rate it has been during much of the past decade.

Sony music to be downloadable

FANS OF MARIAH Carey, Celine Dion and other music artists under contract with Sony's music studios, will soon be able to download the latest single recordings from Sony's online music store at a cost of around US$3.50 per title, the same as the US retail store price. On average, titles will take about five minutes to download.

Sony Music Entertainment said it has teamed up with Microsoft to offer downloadable music using Microsoft's forthcoming Windows Media 4.0 software, which will be available later this year. Windows Media is expected to meet the Secure Digital Music Initiative standards to protect copyrights and ensure secure online transactions. The deal with Sony was made possible in part, after Microsoft made concessions on security matters, and pledging to improve Media 4.0's ability to protect content on the Internet.

"I think it's one of the next frontiers for the industry, as people talk about the convergence of the media and computer industries. To have the opportunity to work with a major company like Sony is very exciting for us", said Microsoft's president Steve Ballmer.

Analysts expect most music studios to start marketing their titles by way of electronic download. While this will hurt their retail partners, music industry executives say they have little choice but to respond to consumer demand for downloadable music. The move is also designed to stem the growth of pirated software that is being sold or given away free online. Sony alone has more than half a million music and video titles in its libraries and making them available online to a global cyber market has the potential of generating a rich new source of revenue.

Other recent moves in the online music market include Universal Music Group, the world's largest music company, which has formed a partnership with InterTrust Technologies to develop a system to download music to PCs in a secure format that prevents mass copying.

National quits PC processor market — again

THE FIERCE MICROPROCESSOR market battle between AMD and Intel has claimed its first victim, as National Semiconductor announced it is throwing in the towel and leaving the cut-throat general purpose PC processor field. Instead, National will refocus its processor business on chips that will add intelligence to a new generation of household appliances.

Reportedly, National is discussing the sale of the Cyrix processor business with IBM and several other large chipmakers, including some based outside the United States. "We have talked to several people and there is significant interest", said National chairman and CEO Brian Halla, who refused to confirm the names of any of the rumoured potential suitors.

It is the second time National has tried but failed to compete with Intel in the microprocessor market. In the mid to late 1980s, National's line of NS16000 and NS32000 processors were more advanced than Intel's 8086 and 80286 lines, but National failed to find enough system houses to build computers around the chips.

National said it will lay off some 600 people, take a US$300 million charge to cover restructuring costs and sell a majority stake in the state-of-the-art Cyrix chip fab in South Portland, Maine.

In the end, Halla said, the competitive battle with Intel and AMD proved to costly for National. "The investments required to fight Intel versus the investments required to dominate the information appliance market are several hundred million dollars apart, and we cannot afford, nor do we need to continue to fight Intel."

Two years ago, National bought Cyrix for US$560 million. At the time, Intel was focused on the high-end processor market, leaving the then-emerging sub-$1000 PC processor market to Cyrix and AMD. Realizing the oversight, which has given AMD a majority position in the retail PC processor market, Intel began this year to compete fiercely with its Celeron chips. 400MHz Celerons are now selling for around US$110.

Like AMD, Cyrix's processor business has been losing money, to the tune of US$45-50 million in the first quarter. ❖

IBM doubles data storage record

IBM'S RESEARCHERS have crammed a record 20 billion bits, or 2.5 gigabytes of data onto a single square inch of disk drive space. IBM has also revealed a US$1 billion deal to make PowerPC chips for a new Nintendo game.

The data storage achievement doubles the previous record set in 1997 by the same group of researchers at IBM's Almaden Research Center in San Jose, IBM's main research facility for data storage technology.

The new level of storage density means the contents of a 90-minute motion picture or the text of 2500 average-sized novels could be stored on a square inch worth of disk space.

IBM also said it has signed a US$1 billion supply contract with Nintendo, to develop and manufacture ICs for Nintendo's video game products. Nintendo will use an IBM 400MHz PowerPC processor for the new game consoles, which will debut in late 2000.

The chip will be made in IBM's plant in Burlington, Vermont, using IBM's copper technology. The PowerPC chip will work with a graphics processor designed by ArtX, a firm based in Palo Alto, California.

Dutch firm buys Wang for US$1.8B

LESS THAN 24 hours after Royal Philips NV agreed to pay US$1.2 billion for Silicon Valley chipmaker VLSI Technology, a second Dutch firm, Getronics, offered US$1.8 billion for the Wang Global Group. The move propels Getronics into a Top Five position in the market for computer service providers, behind IBM and Electronic Data Systems.

The combined operation will have annual sales of around US$5 billion and a staff of 33,000 spread out in 40 countries. The new firm will be headed by Getronics' chief executive officer Cees van Luijk. "Customers want one supplier to do the work worldwide", Luijk said, referring to his company's new ability to assist globally diversified enterprises.

Ironically, Wang's sales of around US$3.4 billion are nearly double Getronics' own sales of $1.6 billion. Following the merger, Wang's name will be 'retired', as Getronics intends to have the combined operation operate worldwide under the Dutch firm's name and logo.

Computer

News & New Products

Active matrix 5" colour TFT LCD monitor

Based on the Philips 5.0" Active Matrix colour TFT LCD module, the TLM050S monitor now available from Amtex Electronics is particularly suitable for the most demanding requirements of the automotive and related industries.

The compact, Plug-N-Play TLM-050S active matrix 5" colour monitor uses thin film transistor LCD technology and is available with a full analog or a digital to analog interface. It is supplied with an internal loudspeaker, audio amplifier, PWM dimming and cable with cinch connectors. The active screen area of 76.79cm^2 (102.7 x 74.8mm) has a high level of brightness and there is a front positioned dimmable backlight and volume control button.

Overall dimensions of the TLM050S are 140 x 113 x 35mm and it can be powered by a single supply voltage of 9 - 16V for automotive applications. Brightness, colour, tint and contrast are potentiometer controlled and the monitor has up/down and left/right scan reversal together with over-heating sensing.

Due to its small size and bright screen, the monitor is claimed ideal for mobile entertainment and information applications, industrial monitoring, fleet management, medical equipment, security instrumentation, computer monitors and video telephone displays.

For more information contact Amtex Electronics, 2A Angas Street, Meadowbank 2114.

Laser-based multifunction centre

Brother's new HL-P2000 Multi-Function Centre incorporates a digital laser copier, laser printer and high resolution scanner in the one box. A virtual 'office in a box', the unit is claimed capable of handling a user's daily printing, copying, and scanning needs, while occupying only the space of a conventional printer.

The HL-P2000's laser printer can print at a speed of 10ppm at a resolution of 600 x 600dpi. Documents can be printed in an array of environments from Windows 3.11, 95, 98, NT 4.0 or even DOS. An added advantage is its ability to automatically switch between PCL, Epson and IBM emulations.

The digital copier in the HL-P2000 allows the user to reproduce up to nine copies via the automatic feeder. Documents can be reduced or enlarged from 50-200%. The copier resolution is equivalent to 200 x 600dpi when in text mode and 300 x 300dpi in photo mode.

The inbuilt 8-bit scanner can scan at a resolution of 600 x 600dpi (interpolated). This Twain compliant device also provides excellent document handling capabilites using Microsoft Wordcraft Unimessage Viewer and Xerox Textbridge OCR software.

For more information call Brother on (02) 9887 4344.

PCI, PXI counters & analog output cards

National Instruments has announced new families of 32-bit counter/timer devices and analog output data acquisition (DAQ) devices for PCI and Compact PCI/PXI computers. All new modules integrate seamlessly with National Instruments LabVIEW and LabWindows/CVI software for fast, efficient DAQ application development.

The 6602 family for PCI and Compact PCI/PXI delivers eight 32-bit counter/timers, each with a gate, up/down, and source input that are controlled by external or internal timing signals. The 6602 family has extended functionality for new applications such as two-signal edge separation measurement, which is difficult to measure with boards using off-the-shelf counter/timers. Each counter can accept source inputs up to 80MHz. The 6602 devices feature eight dedicated I/O lines, as well as 24 shared counter/timer lines.

The new 6711 and 6713 families of analog output modules accelerate update rates for faster waveform generation. These new products, available for PCI and Compact PCI/PXI computers, deliver 12-bit analog outputs with four or eight channels, respectively, and perform waveform generation at rates up to 1MS/s per channel.

The PCI-6704 is a high-resolution voltage and current output device that features 32 independent analog outputs. Of these, 16 are voltage sources with a bipolar range of +/- 10V. The remaining 16 outputs are 0 - 10mA current sources.

For more information contact National Instruments Australia, PO Box 466, Ringwood 3134.

Entry-level tape storage

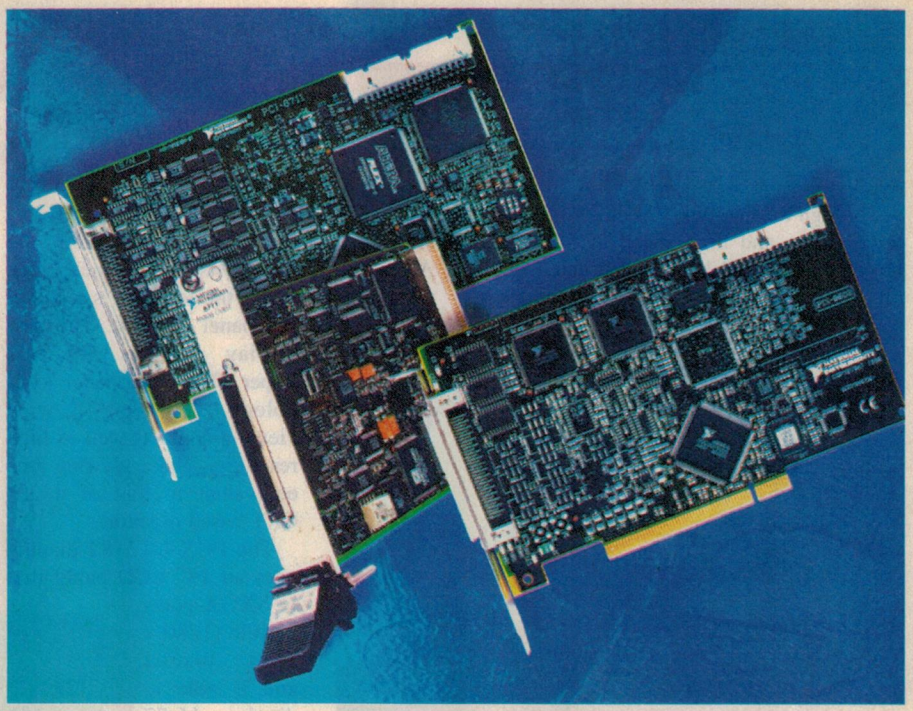
Exabyte Corporation has announced the expansion of its Mammoth Tape Platform product line with the introduction of the Mammoth-LT tape drive, a high reliability tape drive for small to medium size business customers or for those in video, multimedia

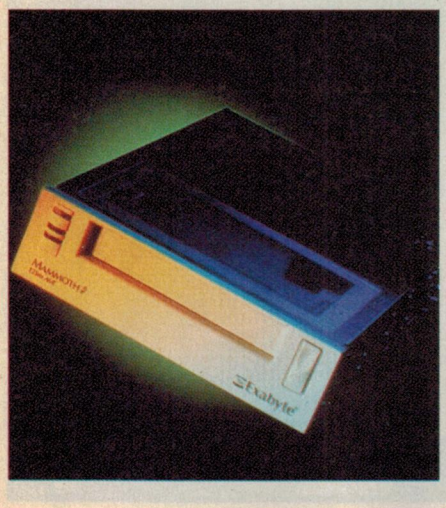
and sound production. The Mammoth-LT delivers 28 gigabytes of capacity and 240MB/min throughput, and can backup 14.4GB in an hour — making it the fastest drive in its class. It is also upgradable to the Mammoth 40GB and 6MB/sec specification if and when required, via Exabyte's Sydney based service and support centre.

The Mammoth Tape Platform is based on a rugged 'Data Centre' reliable tape mechanism featuring low tape speed helical-scan technology. Capstan and pinch-roller free, the mechanism incorporates industrial grade components and shock mounting for the highest possible reliability. MTBF is rated at >250,000 hours with a media life of 20,000 passes and head life of 35,000 hours.

Mammoth LT is available in internal or external low voltage differential (LVD) and single-ended SCSI configurations. It has an RRP of A$3100 ex tax.

For more information contact Exabyte Australia on (02) 9436 4977 or at **www.exabyte.com**.





Consumer-level DV editing solution

Lako Vision has announced the Australian release of Pinnacle Systems' MiroVideo DV200 DV editing solution for Windows 95/98 and NT, a PCI video capture board and software solution that allows users to connect any IEEE 1394 FireWire (or iLINK) compatible device to your PC. DV200 offers a low cost, high performance video editing solution for entry-level DV camcorder users to multimedia professionals, without sacrificing quality and features.

MiroVIDEO DV200 lets users capture video and still images directly to hard disk from their DV camcorders or DV deck without any loss in quality. It includes Pinnacle Systems' DVTools, a complete pre-production software that features tape scanning with automatic scene detection, visual database logging and frame-accurate DV device control. Use Capture Gallery to quickly organize and trim scenes by dragging and dropping in a rough-cut order for batch capturing. For more accurate editing, titling and special effects, DV200 also includes Adobe Premiere 5.1 LE, Adobe PhotoShop LE, Adobe Streamline and Adobe Acrobat Reader.

By rendering changes only, miroINSTANT VIDEO overcomes the Windows 2GB AVI file size limitation, therefore enabling playback of video projects larger than 2GB. DV200 also has two external and one internal IEEE-1394 connectors so you can connect more than one DV device for your video editing suite.

The miroVIDEO DV200 is available now for an RRP of $1199. For more information contact Lako Vision on (03) 9852 7444 or visit their web site at **http://www.lakovision.com.au**.

Slide & film scanner from Canon

Canon has introduced the CanoScan FS2710, a compact desktop slide and film scanner for both Windows and Macintosh platforms capable of optical resolutions up to 2720dpi with outstanding speed. Detailed scans can be created from 35mm slides and strip film as well as from Advanced Photo System film (IX240) — in negative/positive, colour and monochrome formats.

Weighing only 2.2kg and with a footprint of only 85 x 321 x 147mm (WxDxH), the CanoScan FS2710 takes up a minimum of deskspace while delivering accurate, razor sharp scans with 36-bit input for recognition of 68.7 billion colours. Image quality and fidelity is ensured by the use of a high luminosity 'pure white' Xenon fluorescent light source and Canon's improved colour tone algorithm technology for more faithful colour reproduction of film negatives.

Through the combination of a high output light source and high speed SCSI-2 interface, the unit can deliver a maximum resolution scan of 35mm positives and negatives in only 13 seconds, or 10 seconds for a frame of Advance Photo System (APS).

Installation is straightforward as the dual format CD-ROM features an easy to use setup utility. An Adaptec 'Plug and Play' PCI SCSI card is also included to provide PC users with a fast, reliable SCSI data port.

The CanoScan FS2710 comes with CanoCraft FS, a TWAIN-compliant driver for the PC that allows users to access the scanner from within TWAIN compliant applications software. For Apple Macintosh systems Canon includes 'plug-in module FS', compatible with Macintosh OS 7.5 or higher, which gives users quick and easy control over basic scanning parameters and colour adjustments.

Available now from Canon dealers and selected retail stores, the CanoScan FS2710 has and RRP $1499 inc. tax. For more information call Canon Australia on (02) 9805 2000.

18" flat panel display

Hitachi Australia has announced the Australian release of its new 18-inch LCD, the latest addition to the company's series of flat panel displays. The new display employs Hitachi's Super TFT LCD panel technology, delivering a wide viewing angle as well as high resolution and a viewing area equivalent to that of a 20" CRT-based monitor.

The PCX-DT3182 display uses an 18" LCD panel that is SXGA-compatible (1280 x 1024 pixels) and is able to display 16.77 million colours. Because the display is low-flicker, it can be viewed for extended periods without discomfort. The unit also features a lightweight, space-saving design with low power consumption using half the power (about 85 watts) of a typical CRT display.

Hitachi's Super TFT technology used in the new unit incorporates a novel horizontal orientation to the liquid crystals. This differs from the standard vertical crystal orientation used in normal TFT panels, and results in a very wide viewing angle of up to 80° off-centre in any plane. As well, higher refresh rates and number of colours are achievable.

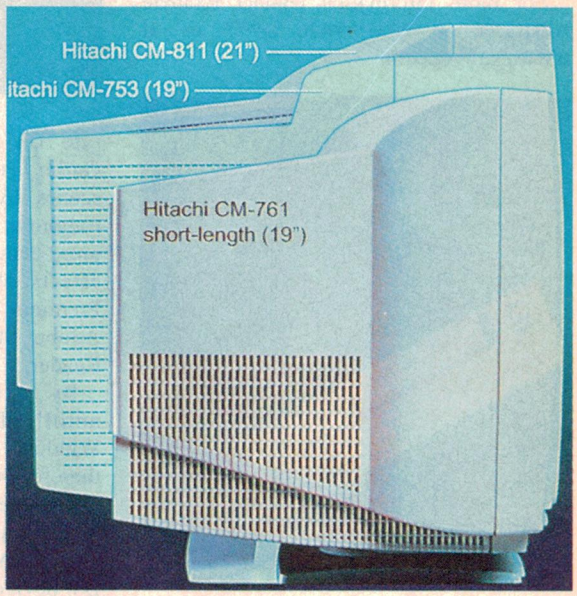
At about 11kg, the new display is only around one-third the weight of a 21" CRT display, has about half the depth (233mm) and takes a minimum of valuable desktop space. It features simple On Screen Display set-up, and full VESA standard Plug&Play makes connection a snap.

The Hitachi PCX-DT3182 will be available third quarter this year from selected dealers around Australia; RRP is $8300 inc tax. For more information contact Hitachi Australia on (02) 9888 4100 or at **www.hitachi.com.au**.

Large screen monitors have smaller footprint

Hitachi's new family of large screen 19" and 21" monitors are claimed to offer the world's smallest footprint in their respective segments. The monitors use a special Short Length Tube (SLT) technology, developed in Hitachi's own tube R&D facilities.

The first SLT monitor available to Australian users is the Hitachi CM-761. Featuring a 19" screen (or 456mm diagonal) this new monitor boasts a rear case dimension of only 395mm, some 60mm less than the average 19" monitor and even less than most 17" units available today. Hitachi claims it is the world's smallest 19" monitor.



The CM761 also features a new flat, high contrast screen, with small 0.22mm dot size for high resolution, and high accuracy focus for the best screen display in its class. Eye fatigue is greatly minimised both by the focus and contrast enhancements and by the increased distance a typical user can now sit from the screen.

Rated at up to 96kHz, the CM761 is designed to be used with today's high frequency graphics cards. At up to 1600 by 1280 resolution and 85Hz refresh rate it features very stable viewing, particularly in professional applications like desktop publishing and CAD.

The CM761 will be available in Australia shortly at a RRP of $1495 inc tax. For more information contact Hitachi Australia on (02) 9888 4100 or at **www.hitachi.com.au**. ❖

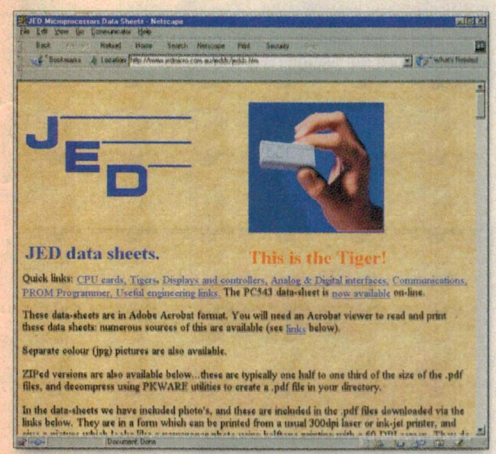
Web watch

by Graham Cattley

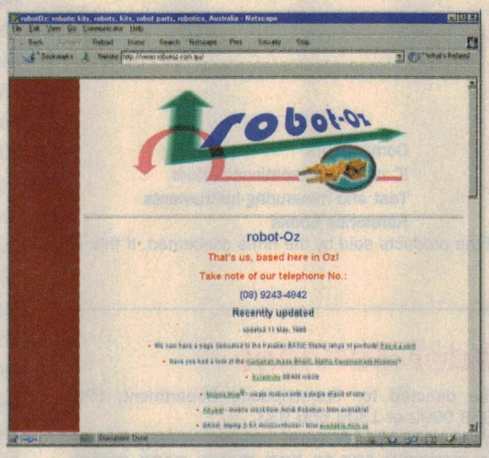
IF YOU ARE a regular reader of EA, then you will no doubt be familiar with JED Microprocessors — they're the people who brought you the famous EPROM programmer and DataSafe, as well as being a major supplier of CPU cards and single board computers in Australia. JED are now the Australian suppliers of the BASIC Tiger and Tiny Tiger microprocessors.

The Tiger is one of a new breed of uP that gives unheard-of performance in a tiny (46-pin DIP) package. 20MHz clock speed, 128KB flash RAM, 128KB CMOS RAM, analog inputs, the list goes on... Tigers are programmed in BASIC, and even offer a multitasking environment that really does make programming much easier.

OK, I'll stop raving on now and just say that if you want to find out more on the Tiger, go to JED's website (**http://www.jed-micro.com.au/JEDDS/JEDDS.htm**) and download a raft of data sheets and other info. As well, there is a list of Tiger-related links including Tiger comparisons and sample applications. Oh, and while you are at the JED site, be sure to read the Penguin Report — compiled with the help of a JED micro.



AND SPEAKING OF microcontrollers, RobotOz at **http://www.robotoz.com.au** are a good source of bits for Basic Stamp based robots, with servo motor controller boards, Stamps, Stamp books and so on. They also



sell a number of Robotics kits (including BEAM robotics), and other useful items like Muscle Wire and a number of books on robots and robot building. Worth a look...

IF YOU WANDER over to **http://www.cadsoftusa.com**, you'll find CadSoft's site, home of the Eagle Layout Editor PCB design package. The Eagle Layout Editor is a Windows based schematic capture and PCB routing tool with all the usual features, as well as a couple of useful tools such as 'copper pouring'. You can download a free demo version from the site, and to help you drive the package there is a step-by-step slideshow presentation on the site. You can either view it on the web or download it to view later. (The latter is recommended if you don't have a fast connection.)

The CadSoft site has a couple of unusual features that are worth exploring, the most interesting being a file *upload* facility. Here people can submit files, programs, component libraries and tutorials for others to use, and there seems to be quite a collection of stuff there, particularly for Eagle users. The site even devotes a page to record covers of songs containing the word 'Eagle' — a bit strange, but this is the web after all... Many thanks to EA reader Graham Pratt for coming up with this site.

ICESOFT TECH CO., at **http://www.semi.com.tw** is a site recommended by EA reader Jo Mount, and it is one of the most 'no frills' datasheet finders that I've come across. It sure works though, and it's nice and fast too. You can search any one of over 100 semiconductor manufacturer databases (or the whole lot at once), and your search can also include wildcards such as 74*11. The spelling on the site is a bit suspect in places, and their 'Home' link is broken, but on the whole the site is A Good Thing, and well worth bookmarking.

DOUGLAS SELF has certainly made a name for himself in the audio engineering field, and quite rightly so. He is a very technically competent person, and has designed (and written about) a large number of ultra high quality amplifiers, preamps, and other pieces of audio equipment.

Doug's site at **http://www.dself.demon.co.uk** covers a lot of his work, including photos and details of many of his designs. It is also the home of a number of Doug's articles on audio design principles, including detailed discussions on power amplifier distortion, advanced mixer design, noise, distortion and dynamic range. He explains everything quite clearly, and if you aren't too sure about dBu or Johnson noise, then I'd recommend that you explore this site, suggested by EA reader Rob Wallis.

In the process you might venture into Doug's 'Roswell incidents for Roswell innocents' page, where — as he says, "...It may not be what you are expecting, it may not be what you like, but it IS the truth." He's right. Check it out! ❖

EA Directory of Suppliers

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
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Dick Smith Electronics	ALL	•	•	•	•	•	•	•
Emona Instruments	NSW						•	
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KEY TO CODING

A	Kits and modules	D	Components
B	Tools	E	IC chips and semiconductors
C	PC boards and supplies	F	Test and measuring instruments
		G	Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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PHOTOCOPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: Reader Services Co-Ordinator, Electronics Australia, P.O. Box 199, Alexandria NSW 1435; phone (02) 9353 0620. (E-mail to elt@hannan.com.au)

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ADVERTISING INDEX

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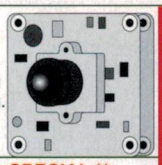
COLOUR CCD 42X42mm CAMERAS



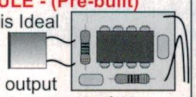
with 1 of these lenses 3.6mm-92 deg./4.3mm -78 deg. 5.5mm60 deg. Special introductory Price of just $189

** CCD CAMERA SPECIAL ** WITH A FREE UHF MODULATOR

The best "value for money" CCD camera on the market! 0.1 lux, High IR response & hi-res. Better than most cheaper models. **32 X 32mm $99...** With 1of these lenses pinhole (60deg.), 92 deg.; 120 deg. or for (150 deg) add $10

MINI AUDIO MODULE - (Pre-built)

This amp/pre-amp is Ideal for use with our cameras. 12Vdc, Hi sensitivity, 0.6W output operation includes electret mic. $10

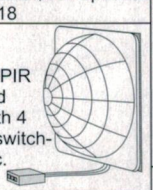


4 CHANNEL VIDEO SWITCHER KIT

This kit can switch manually or sequentially up to 4 audio/video sources. Other features inc. VCR relay output to switch STOP/REC, can be switched with PIR or alarm system inputs Add a security channel to your TV using a VHF modulator, watch TV & flick channels & see who's at the door or what the Kids are doing. This unit can be switched auto-matically using the PIR units below. Kit +PCB+all on-bourd components inc. 18 relays. Less than Half price of most units $50. Optional VHF modulator / mixer $18

MINI PIR DETECTOR PCB MODULE (G66)

Pre-built 30mmX34mm PIR module with an attached Freznel lens & cable with 4 pin connector Ideal for switch-ing cameras, alarms etc. bargain at just: $18



POWERFUL IR ILLUMINATORS

With strong universal swivel mount & 50X50X50mm housing:10 LED $10... 30 LED $20...80 LED $36

NEW 35-140 LED IR ILLUMINATOR KIT

Switches on when it gets dark or can be controlled by alarm sys-tems. With suitable mount & swivel wall mount...35 LEDs $25. Extra 35 LED packs (3 max.) $14 per pack kit with 140 LEDs:$67

VCR CONTROLLER KIT:

Ref: SC Sept 97. With our Trigger Kit, a used PIR Det. & Learning Remote. It can trigger a domestic IR remote controlled VCR to record human activity within 6m & 180deg. Starts VCR recording with move-ment & stops a few min. after last move-ment. Relay outputs, easy interface with a VCR/Remote Control. PCB & all on board parts:$25. A mini used PIR module: $16.

F R E E * * * F R E E * * * F R E E

Ask for a free mini Hi quality VHF modulator with any camera order.

BARGAIN PRICED SPECIAL

We have fresh stocks of brand new 12V / 7Ah gel batteries...$22

FOR MORE GREAT DEALS ON CCD cameras and video accessories see our other ad this issue or see our **NEWLY UPDATED WEB PAGE WHERE YOU WILL FIND.....**

Powerful camera pan and tilt units... Lenses with motor driven Zoom, Focus, Aperture, control...Aircraft control surface actuators...Cleverly disguised home or business safes...& lots more !!!

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***NEW KITS ***

UHF AUDIO / VIDEO TRANSMITTER KIT

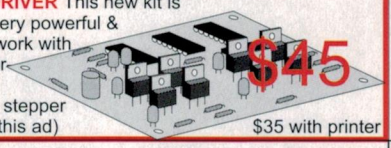
Kit includes all components needed.....

PCB plus all on-board components, connectors, switch, metal case, telescopic antenna, twin RCA A/V lead, all that is needed to complete the full kit. 12Vdc @10mA operation. Ideal for transmitting audio and video around you home.. Complete Kit for just $25

$25

NEW MOSFET STEPPER MOTOR DRIVER

This new kit is designed to work at 5V or more & is very powerful & very efficient (very little heat) and to work with software like DANCAD etc.(for step/dir-ection signals) and is ideal for CNC projects. It will work very well with the stepper motors from the German printer (see this ad)

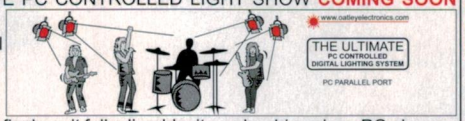


$45

$35 with printer

LOOK! THE ULTIMATE PC CONTROLLED LIGHT SHOW COMING SOON

From the hardware to the software, this is a professional kit in every way. The software is professionally written with attention to detail. It can per-form... single or multi chases, flashes, it fully dimable, it can be driven by a PC alone or with support from a sound card. Just about any lighting affect you can think of.



NEWWHITE LED 5mm 3500mcd.

Very bright Ideal for mini torch etc.... $4

OPTO PACK

A total of 104 opto devices: 94 various colours and types. All top quality brands. Note that minor the ratio / types of visible LED's supplied may vary.

VISIBEL LEDs...5mm

14 X Yellow clear...6 X Red (clear) 24deg....2 X Yellow LED (clear) 24deg. 16 X Red LED (clear) 24deg...38 X Green LED (clear) 24deg.

$10

3mm

14 X Red LED diffused 70deg. 4 X 3mm or rect. Yel. LED diffused 70deg

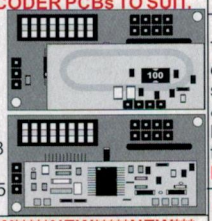
SPECIAL

1 X 5mm IR LED blue...3 X 3mm Clear Phototransistor...3 X 5mm Clear Phototransistor...1 X IR Receiver module 2 X DIL rect. black PIN Photodiode.

NEW***NEW*****NEW*****NEW***

SAW RESONATOR LOCKED. NO TUNING 433 MHz UHF DATA TX & RX MODULES +ENCODER PCBs TO SUIT.

Many security codes, 4 zones, multi channel. See our WEB SITE for more



TX module $11
TX + encoder $18
RX module $18
RX + encoder $25

NEW**NEW*****NEW*****NEW***

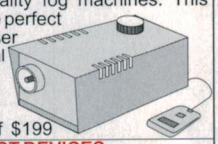
QUALITY AUSTRALIAN MADE FEATURE PACKED MINI ALARM SYSTEM.

Features inc. boot release, central locking output, imobiliser output, indicator flash relay. Has with 2 key-fob transmitter keys.

Drawn in proportion

FOG MACHINES..... JUST ARRIVED

Professional quality fog machines. This unit would be the perfect partner to our laser light shows, Ideal for discos, parties, fashion parades etc. A special price of $199



PELTIER EFFECT DEVICES

Make a solid state food cooler / warmer for the car etc. with 2 heatsinks, a fan and one of the following. Could be used for cooling overclocked PC CPUs. All 40 X 40mm.

4A △T 65deg. Qmax 42W $25
6A △T 65deg. Qmax 60W $27.50
8A △T 65deg. Qmax 75W $30

Device comes with instructions to build cooler / heater plus data. Some used surplus heatsinks avail.

N E W * * * N E W * * * N E W * * * N E W

PELTIER CONTROLLER: This kit is a sw-mode design & correctly controls temp. of peltiers to 10A (very efficient design) PCB + onboard parts + new surplus case. $15

14V @ 3A+ TRANSFORMERS

Low profile flat pack type. Fully lacquered Quality Australian made $12 or 3 for $30

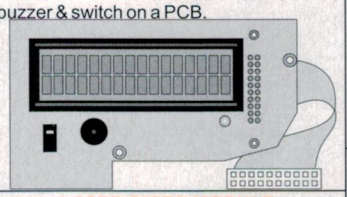
N E W * * * * * * * * N E W * * * * * * * N E W

HIGH QUALITY 4 FREQU. CRYSTAL LOCKED 2.4GHz AUDIO / VIDEO LINK.

Will suit VCRs or Video cameras. Range of up to 100M 2.4 GHz. 12V operation VCRs DC plugs supplied (no plug packs) .

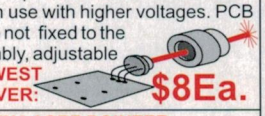
$199 PAIR

16 X 2 LINE LCD CHARACTER DISPLAY + 1M IDC ext. cable, LED, buzzer & switch on a PCB.



LASER DIODE MODULE

These very bright 5mW/650nM modules employ a simple 4.5V driver circuit: Data supplied on use with higher voltages. PCB & diode are not fixed to the lens assembly, adjustable focus. **LOWEST PRICES EVER:**



$8Ea.

KEY-CHAIN LASER POINTER

in a presentation box. Quality machined metal housing + 3X LR44/AG13 batteries **FREE.** Extra batt-eries 50c Ea.

$10

6 CELL NIMh BATTERY PACK

Brand new 1Ah 7.2Vwith built in fuse (can be link-ed out) & heat sensor to monitor charging.

$6

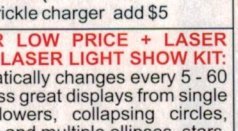
BATTERY PACK

These are used & were re-moved from equipment as part of routine maintenance. We can't fault them. Some 4 some 6 cell. $0.20 / cell. Guaranteed!

CHARGER PCB (to suit above 6 cell packs) 7.2V trickle charger add $5

NEW SUPER LOW PRICE + LASER AUTOMATIC LASER LIGHT SHOW KIT: MKIII.

Automatically changes every 5 - 60 secs. Countless great displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. Easy mirror alignment with "Allen Key". Kit inc. PCB, all on board comp-onents, three small DC motors, mirrors, precision adjustable mirror mounts: (K115) + very bright 650nM laser (LM2) module. Kit with laser module $55 Kit + laser module + plug-pack + instument style case all at a special price of $70



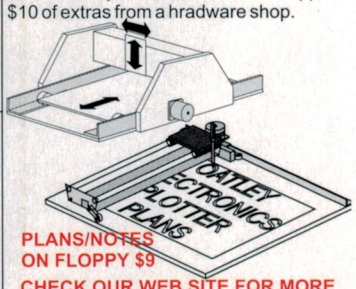
$55

NEW...PC MOTHERBOARD

UMC-486 CACHE ISA SX 40Mhz. In original packaging and **With 486-40Mhz CPU**, booklet & QA report. inc..., 5 X 16 bit & 1 X 8 bit slots, space for 4 X 32 pin SIMMS & 1 X 72 pin SIMMS, com-pact (220mm X 170mm)

BUILD YOUR OWN COMPUTER CONTROLLED 2/3 AXIS CNC MILLING MACHINE / ENGRAVER OR PEN PLOTTER:

This system is designed to work with special CNC shareware available on the net (this software is suitable for professional CNC work) Using the parts of our $46 surplus printer that is chock full of steppers, toothed belts, pulleys, bearings etc (see Electronics Australia June 99). we have plans for $9 (on floppy) & info to find lots of shareware on the net for plotting, engraving, milling & drilling. Minimal work for an A3 plotter as some major parts are already built. Con-struction requires minimal tools + approx. $10 of extras from a hradware shop.



PLANS/NOTES ON FLOPPY $9

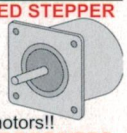
CHECK OUR WEB SITE FOR MORE

LOOK LOOK** LOOK**

NEW STEPPER MOTORS

30 oz./in. torque, 2.5 deg. 144 step, low voltage, compact 57 x 38mm: $14

COMPUTER CONTROLLED STEPPER MOTOR DRIVER KIT

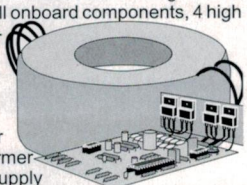


can drive larger motors, Has optoIsolation. Inc. Software & notes: $40 Or $50 with two Used 23 frame 200 step 1.8 Deg. motors!!

CHECK OUR WEB SITE FOR DRIVERS

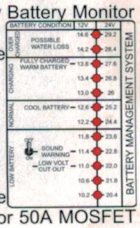
NEW 12VDC-240VAC/300VAINVERTER

This new design is very efficient, is rated at 300VA constant not peak (when our transformer is used). It has auto switch on and uses High power MOS-FETS that require very minimal heat-sinking. The kit inc. PCBs, all onboard components, 4 high power MOS-FETs and all for $35 To save money you can use your own transformer or we can supply the Kit + a high quality compact toroidal transformer plus wiring kit plus a used large electrolytic capacitor for $89



COMPLETE INTELLIGENT BATTERY / POWER MANAGEMENT SYSTEM

For the home or car New Battery Monitor Kit:12v / 24v monitor with low voltage cutout, audible alarm before cutout. Designed to use minimal power & has a battery saving 12 led bar-graph indicator. Kit inc PCB, all onboard parts, label, 10A cutout MOSFET + suitable surplus case for $32....For 50A MOSFET (IRFZ44) add $3.



To complete your solar system we have **12-24V SOLAR REGULATOR KIT:** 15A Kit inc all onboard parts & PCB. $25

EA-JLY-99

KEF Q-Series Home Theatre

audio works

LUXMAN

KEF

audioquest

CELESTION

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Reader Info No. 7